ALine East
AN ALLIANCE TO UPGRADE GREAT EASTERN HIGHWAY

ENVIRONMENTAL IMPACT ASSESSMENT DESIGN PACKAGE 8 (SLK 264.3 – 267.0) GREAT EASTERN HIGHWAY

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EXECUTIVE SUMMARY

The Great Eastern Highway is the main link connecting Perth to the Eastern States, carrying commuter traffic, regional and interstate road freight. Much of the existing road pavement between Kellerberrin and Carrabin is about 40 years old and is relatively rough. During the past 10 years several sections of the road have been upgraded, resulting in a road with varying standards of geometry, surface roughness, width and overtaking opportunities. Some sections are deficient in width for the amount and type of traffic that use the road. There are also sections with poor alignment, thus increasing travel times and affecting safety.

The Western Australian Government has formed an alliance, Aline East, which is made up of representatives from Main Roads Western Australia (Main Roads), Brierty Contractors, BG&E and WML Consultants to widen and realign the deficient sections of Great Eastern Highway between Kellerberrin and Carrabin.

The project area has been divided into the following Design Packages (DPs), which are proposed for construction over the next two years:

Design Package (DP)	From (SLK)	To (SLK)	Length (km)	Possible Treatment	Construction Season
DP 1	239.2	245.2	6.0	Re-Condition / Widen / Overlay	S1
DP 2	251.6	256.25	4.65	Shoulder Widening	S1
DP 4	267	278.9	11.9	Re-condition / Widen / Overlay	S1
DP 5	282.4	290.1	7.7	Widen /Overlay / Rail Overpass	S1/S2
DP 6	234.7	239.2	4.5	Realignment	S2
DP 3/7	245.2	251.6	6.4	Realignment	S2
DP 8	264.3	267.0	2.7	Realignment	S2
DP 9	278.9	282.4	3.5	Realignment	S2
DP 10	257.8	264	6.2	Widen	S2
DP 11	198.4	202.75	4.35	Townsite & Intersections	S2

For the project to proceed, environmental approval will be required from the Environmental Protection Authority (EPA) under Section 38 of the *Environmental Protection Act 1986* for some of the Design Packages. Where necessary, these design packages will be referred for assessment in accordance with the Memorandum of Understanding between the Main Roads and Department of Environmental Protection (now the Department of Environment and Conservation[DCE]) (2000).

This EIA addresses the environment factors within Design Package 8 (DP 8) as identified in the Preliminary EIA undertaken by Kellogg Brown and Root (KBR, 2005). The principle issues relating to DP 8 are consistent with issues identified as possible constraints during preliminary discussions with the DoE.

Specialist flora, fauna, noise and Aboriginal and European heritage surveys have been undertaken for the area.

The project will have no impact on any Declared Rare Flora, Priority Flora or Threatened Ecological Communities. However four trees rated as having Very High Significance are likely to be cleared and approximately 3.1625 ha of remnant vegetation in Good to Very Good condition will be cleared.

The clearing will have no impact on significant fauna or on any Environmentally Sensitive Areas (ESAs).

Acoustical modelling determined that the predicted noise levels resulting from the implementation of the proposal will comply with Main Roads Noise Level Objectives and the WAPC's Draft Planning Policy for Road and Rail Transport Noise.

Environmental factors relating to the design and construction of DP 8 are summarized in Table 1. This document addresses these environmental factors, along with the potential impacts of the proposed road upgrade and preliminary management measures to minimise or prevent these impacts and suggests other recommendations.

Required Approvals

Of the environmental factors identified, none are considered potentially referable to the EPA. There is no requirement for the proposal to be referred to the Commonwealth under the *Environment Protection and Biodiversity Conservation Act, 1999*.

TABLE 1
SUMMARY OF ENVIRONMENTAL ASPECTS AND IMPACTS ASSOCIATED WITH DP 8

ENVIRONMENTAL ASPECT	ISSUE	IMPACT
Environmentally Sensitive Areas	No Environmentally Sensitive Areas occur within or adjacent to the project area	The project will not impact on any Environmentally Sensitive Areas
Vegetation and Flora		
Clearing of Vegetation	Clearing of 3.1625 ha of remnant vegetation of Vegetation Association 36 (Beeston et al, 2002) in Excellent to Good Condition.	1.1825 ha of the 4.345 ha within the clearing envelope has been extensively modified due to grazing, gravel extraction and access tracks and 3.1625 ha of the vegetation is in relatively Good to Very Good Condition. Approximately 49.7% of the pre European extent of Vegetation Association 36 remained in 2002 (Beeston et al, 2002).
Threatened Species	No Declared Rare or Priority species or Threatened Ecological Communities (TECs) present	na
Significant Trees	Depending on species, mature trees with a circumference at breast height of >2.0m, are of significance due to their age, aesthetics and the presence of nesting hollows for parrots	Four trees rated as having Very High Significance will be cleared. Three trees rated as of Medium Significance are also to be cleared.
Dieback	Dieback has not been recorded east of Northam	na

ENVIRONMENTAL ASPECT	ISSUE	IMPACT
Weeds	Area contains various weed species but no Declared weeds	Potential risk of importing and spreading weeds to remaining vegetation
Topsoil management	Topsoil may contain seeds of weed species	Respreading topsoil may promote spread of weed
Fauna		
Fauna - general	A number of fauna may potentially use the area	Loss of Good and Very Good Condition habitat will remove and displace some of the smaller fauna
Threatened Fauna	Four species of threatened fauna (Carnaby's Black Cockatoo [Schedule 1], Peregrine Falcon, Rainbow Bee-eater and Fork-tailed Swift) are expected to occur in the study area.	The Peregrine Falcon, Rainbow Bee-eater and Fork-tailed Swift are migratory species. Given the minimal and linear nature of the clearing, the project is unlikely to have a significant impact on any of these species. Carnaby's Black-Cockatoo may utilise the remnant vegetation for feeding. DP 8 did not contain trees with hollows of adequate size to support Carnaby's Black Cockatoos. The project is not expected to have a significant impact on this species.
Conservation Reserves	No conservation reserves or other significant bushland within or adjoining the site. An A class reserve vested in the Shire of Merredin for the purpose of Recreation (Reserve No 23580) is located 1.3km to the west of the western boundary of DP8. Given the distance from the A class reserve, it is unlikely that the proposed clearing will impact on the reserve.	na
Surface Water, Groundwater and Drainage	No wetlands or surface drainage lines. No potable water catchments or resource protection areas	na
Surrounding Land use	Project is adjacent to two residences at SLK 265.75. One residence is about 200m south of the existing alignment and 60m north of the proposed realignment. The other residence is about 450m south of the existing alignment and 150m south of the proposed realignment.	Potential for noise, dust and disruption during and following construction.
Contaminated Sites	No contaminated sites identified or likely	na

ENVIRONMENTAL ASPECT	ISSUE	IMPACT
Noise and vibration	Two residences are located near SLK 267.75, about 200m and 450m south of the existing alignment and 60m north and 150m south of the proposed realignment.	No noise amelioration is required as the project will comply with Main Roads noise level objectives and the Draft Planning Policy for Road and Rail Noise. However, following consultation with the residents a noise bund will be constructed.
Aboriginal Heritage	No sites of ethnographic or archeological significance within the project	na
European Heritage	No registered sites within or adjacent to the project area	na
Visual amenity	Project will result in clearing of 3.1625 ha of remnant vegetation. Four trees rated as having Very High Significance and three trees rated as having Medium Significance will be cleared. Most of these trees are currently not seen from the existing alignment.	No significant change is visual amenity.

1. INTRODUCTION

1.1 Background

The Great Eastern Highway is a major transport and tourist route to the Goldfields and eastern states. The section of Highway at Kellerberrin and between Hines Hill and Carrabin is to be upgraded to improve safety standards.

The project area has been divided into six design packages (DPs), which will be constructed over the next two years (Figures 1 and 2a-d). Proposed works for DP 8 are defined as follows:

Package	SLK	Length (km)	Treatment
DP 8	264.3 – 267.0	2.7	Widen/Overlay and Realignment

Aline East appointed ATA Environmental to undertake a series of environmental assessments for the project, including the EIA for this Design Package.

This report constitutes the EIA for DP 8 (264.3 – 267.0) (Figures 2a–d).

A Preliminary EIA was prepared by Kellogg Brown and Root (2005) for proposed works on Great Eastern Highway between Chedaring Road and Northam (SLK 59 and 90) and between Hines Hill and Southern Cross (SLK 225 – 366.4).

1.2 Scope of Report

This EIA identifies the existing environment, potential impacts of the proposed road upgrade within DP 8 including those environmental factors identified in the Preliminary EIA and management measures to minimise or prevent these impacts.

This EIA may be referred to the Environmental Protection Authority (EPA) for assessment under Section 38 of the *Environmental Protection Act 1986* although it is unlikely that it will be necessary to obtain statutory approval from the EPA in order to proceed with DP 8.

The report contains detailed information from desktop and field investigations to determine whether the proposal needs to be referred to and assessed by the relevant authorities.

2. DESCRIPTION OF THE PROPOSAL

2.1 Location

Design Package 8 comprises 2.7km of Great Eastern Highway to the east of Merredin. Approximately 1.9km of the highway will be realigned 300m to the south of the existing alignment. (Figures 1 and 2a-d).

2.2 Justification and Objectives

Great Eastern Highway is being upgraded by widening, overlay and realignment between Kellerberrin and Carrabin to improve road geometry, surface roughness, width and overtaking opportunities. This will contribute to reduced travel times and improved safety.

DP 8 is one section of the highway identified for upgrade. It will generally follow the existing horizontal design except for 1.9km realignment to the south from SLK 264.8 to 266.7.

2.3 Legal Framework

In addition to meeting the requirements of the *Environmental Protection Act 1986* the proposal is required to comply with, amongst others, any or all of a number of Acts of Parliament and Regulations at the State and Commonwealth level as listed below:

- *Aboriginal Heritage Act, 1972;*
- *Agriculture and Related Resources Protection Act 1984,*
- *Conservation and Land Management Act 1984;*
- *Environment Protection and Biodiversity Conservation Act, 1999;*
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004;*
- *Heritage of Western Australia Act, 1990;*
- *National Heritage Trust of Australia Act 1997;*
- *Soil and Land Conservation Act 1945;*
- *Soil and Land Conservation Act 1945-1982;*and the
- *Wildlife Conservation Act 1950.*

The approvals process is aligned with the Memorandum of Understanding between Main Roads and the Department of Environmental Protection (2000) and the Main Roads Project Purpose Permit (2006). The environmental impact assessment and approval process related to this project is outlined in Table 2.

TABLE 2
IMPACT ASSESSMENT AND APPROVAL FLOW CHART

ENVIRONMENTAL IMPACT ASSESSMENT (DESKTOP & FIELD)

- Aspect 1: Aboriginal Heritage Sites
- Aspect 2: European and National Heritage Places
- Aspect 3: Threatened Fauna – particularly Carnaby's Cockatoo nesting sites
- Aspect 4: Flora – DRF, Priority Species, Nationally Threatened species, ESAs, significant trees
- Aspect 5: Land tenure – CALM A Class Reserves, World Heritage properties, Commonwealth land
- Aspect 6: Vegetation – Threatened Ecological Communities & Nationally Threatened Communities, remnant vegetation
- Aspect 7: Riparian beds, banks and surface water
- Aspect 8: Wetlands – RAMSAR, ESAs
- Aspect 9: Noise

↓

INCORPORATE ENVIRONMENTAL ASPECTS INTO DESIGN

- Environmental constraints incorporated into design plan.
- Alignment selected to minimise impacts

↓

REFER PROPOSAL AND INTENDED REFERRALS TO MAIN ROADS

Northam Region then Perth to ensure that the assessments and referral strategy have been undertaken in accordance with Main Roads Environmental Guidelines and Project Purpose Permit to Clear Native Vegetation (1st February 2006)

↓

SUBMISSIONS REQUIRED

If the impacts of proposed clearing are at variance with the clearing principles in the Main Roads Project Purpose Permit (1st February 2006) then the following parties must be invited to comment:

- DoE Native Vegetation Protection Branch;
- Clearing Assessment Unit of the Environmental Protection Branch in DEC;
- The Office of the Commissioner of Soil and Land Conservation in the Department of Agriculture;
- The Conservation Council of Western Australia Inc.;
- The local government responsible for the areas that is to be cleared;
- The owner (as defined in section 51A of the EP Act), or occupier (as defined in section 3 of the EP Act), of any land on which the clearing is proposed to be done;
- Any other environment or community groups that considered to have an interest in the proposed clearing;
- Any other party that is considered to have an interest in the clearing proposed to be done.

The submission period must be at least 21 days. Any submissions received must be addressed in an EIA report in accordance with condition 7(k) of the Main Roads Project Purpose Permit.

2.4 Key Project Characteristics

The following table includes the key characteristics associated with the proposed construction and upgrade of Great Eastern Highway through DP 8, including the nature and extent of the works to be undertaken.

TABLE 3
KEY PROJECT CHARACTERISTICS

Element	DESCRIPTION
Construction Duration	Winter/Spring of 2006
General Standards of Design and Construction	Design speed 110km/h. Main Roads standards
Length of Section	2.7km
Proposal Description	Design, construction and use of a highway of two lanes at approximately 5km east of Merredin within the Shire of Merredin. The proposal includes construction of all road pavements, associated earth works, culverts, fencing, rehabilitation and signs. A parking stop at the eastern end of the realignment (between new SLK 266.3 and 266.5) is incorporated into the design.
Typical cross-section	A total of 16.6m comprising 2.6m for table drains, 12m for carriageway, 2m for sealed shoulder. Widening works on both sides of road for approximately 6.0 m with the vertical profile lifted between 100 and 300mm (See Figure 3)
Vegetation to be Cleared	Approximately 1.1825 ha of completely degraded vegetation and 3.1625 ha of remnant vegetation (Table 7)
Water Requirements	Approximately 300-400KL/day of which 60% would be fresh (2000mg/L) and 40% saline water.

DP 8 extends from SLK 264.3 – 267.0 with widening works on both sides of the road for approximately 6m either side of the centerline with realignment to approximately 300m south of the existing road and associated improvement intersection with the Booraan South Road. The vertical profile will be raised between 100 and 300mm.

2.5 Timing and Staging of the Project

The final design for DP 8 is almost completed. Subject to environmental approval being granted for the proposal, construction is scheduled to commence as soon as possible and will continue over the summer of 2007. The remaining sections of the upgrade project are scheduled for construction in the summer and autumn of 2006-2007.

3. EXISTING ENVIRONMENT
3.1 Physical Environment

3.1.1 Climate

Merredin, the meteorological station closest to the project area, has a temperate climate with warm and dry summer days with clear skies. A band of high pressure known as the subtropical ridge dominates the weather in the region. The typical position of this ridge changes during the year and the prevailing winds in Merredin change correspondingly from easterly in summer to westerly in winter. Winter temperatures are mild with a most of the average rainfall being received during this period. The mean annual rainfall recorded at Merredin over the past 100 years is 328.4mm over 70 rain-days. Mean daily maximum temperatures range from 33.7 degrees Celsius in summer to 16.2 degrees in winter. Mean minimum temperatures range from 17.9 degrees Celsius in summer to 5.4 degrees in winter.

The average mean temperatures (over a 38 year recording period), rainfall and number of rainy days (recorded over 100 years) at the Merredin Bureau of Meteorology Station 010092 are shown in Table 4.

TABLE 4
SELECTED CLIMATIC PARAMETERS AT MERREDIN

Mean	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily Max ^{o}C	33.7	32.9	30.0	25.2	20.4	17.2	16.2	17.1	20.4	24.5	28.3	31.9
Daily Min ^{o}C	17.7	17.9	16.0	12.9	8.9	6.8	5.6	5.4	6.8	9.4	12.9	15.8
Rainfall (mm)	13.2	15.8	20.8	23.5	41.6	51.1	51.6	39.4	25.4	17.9	14.1	14.0
Rainy days	2.1	2.5	3.2	4.7	8.0	11.1	12.1	10.3	7.2	5.0	3.2	2.5

3.1.2 Geology, Soils and Landforms

The underlying bedrock of the project area is estimated to be 2-3 billion years old Archaean tectonic unit known as the Yilgarn Craton and comprises crystalline granite and gneiss rocks. No outcropping or surface expressions of these rocks are found within DP 8.

Ten major soil associations, or land management units, have been identified in the Merredin area. The most common soil association within DP 8 is the Merredin soil group which is described as red-brown sandy loam to sandy clay loam surfaced soils with red-brown alkaline subsoils. This soil type is often associated with *Eucalyptus salmonophloia* and *Eucalyptus salubris*. Rising salinity and acidic soils are problematic within the Shire of Merredin (Lantzke, 1992), however acid soils are unlikely to pose a problem if, as anticipated; excavations during construction do not exceed 2ms below current surface levels.

The topography within DP 8 is relatively flat and valleys are shallow with only 60m from valley floors to divides with gradients between 1:1000 and 1:1500.

3.1.3 Surface Hydrology

The entire project is located within the Yilgarn Catchments of the Avon River Basin (Australian Water Resource Council basin number 615). This basin is located in the Northern Zone of Ancient Drainage which contains extensive chains of salt lakes extending out to Southern Cross that have connected surface flow only in exceptionally wet years (e.g. 1963 and 2000) (Viney and Sivapalan, 2001). When surface water does flow it ultimately drains into the Yilgarn River with a catchments area of 55,900km^2 and then into the Avon and then Swan Rivers. In average rainfall years, surface water drainage is internal and the playa lakes act as sumps in which salts accumulate (i.e. seasonal salt lakes). The lakes are inter-connected by very limited ground water movement. There are no wetlands within DP 8.

There are large areas of secondary salinity on the valley floors and the potential for salinity to spread is high because of the low relief and regional ground water pattern. The Avon Catchments Council (2005) has estimated that up to 30% of agricultural land will be affected by salinity and two-thirds will require some treatment for soil acidity by 2050.

3.1.4 Groundwater Hydrology

Groundwater systems in this region are not fully understood. However, it is known that the water table has risen since broad scale clearing commenced and groundwater has also become more saline. Dryland salinity is common in the Shire of Merredin and occurs when the shallow saline groundwater rises by capillary action through the soil. There has been limited deep drilling for water supply in this area. There is no plan to abstract groundwater for the project within the zone of influence of DP 8.

Demand for water during the construction of DP 8 will be approximately 300-400KL/day of which 60% would be fresh (2000 mg/L) and 40% saline water. This water will be sourced from the following:

- treated effluent from the Merredin Wastewater Treatment Plant and saline water from two Department of Agriculture bores will be stored in three water tanks located at a Wash Down Bay immediately north of Dam 3, which contains runoff from the CBH Building;
- Freshwater will be drawn from Dam 3 after installation of a pump and standpipe; and
- Any shortfall of freshwater would be sourced from the Water Corporation standpipes managed by the Shire of Merredin.

Any abstraction of groundwater will be licensed in accordance with the requirements of the *Rights to Water and Irrigation Act 1914.*

3.2 Vegetation and Flora

3.2.1 Methodology

An assessment of the vegetation and flora adjacent to the Great Eastern Highway within DP 8 was undertaken between October 31 and November 2, 2005. The proposed realignment area was surveyed on the 12th July 2006. The assessments were undertaken to provide a description of the dominant vegetation communities, vegetation condition and flora species present within the study area. The surveys concentrated on the vegetation and flora within the gazetted road reserve and proposed road realignment area wherever access was possible. The survey was undertaken by traversing the study area on foot and by vehicle to identify significant species and vegetation types that may potentially be impacted. Three temporary 10 x 10 m vegetation quadrats were established in remnant vegetation in the realignment area.

A desktop search was undertaken to identify significant flora or vegetation communities that could potentially occur in the study area. This investigation encompassed a review of the following Department of Conservation and Land Management (CALM) databases:

- CALM's 'Threatened Ecological Communities' database;
- CALM's 'Threatened (Declared Rare) Flora' database; and
- CALM's 'Declared Rare and Priority Flora' database, which contain species that are Declared Rare (Conservation Code R or X for those presumed to be extinct) poorly known (Conservation codes 1, 2 or 3) or require monitoring (Conservation Code 4).

3.2.2 Significant Flora

The results of the (CALM) Threatened (Declared Rare) Flora database and the CALM's 'Declared Rare and Priority Flora' database search are presented below in Table 5.

TABLE 5
SPECIES OF SIGNIFICANT FLORA RECORDED IN THE VICINITY OF THE ALINE EAST PROJECT AREA

Species/Taxon	Conservation Code	Flowering Period	Preferred Habitat
Acacia ancistrophylla var. *perarcuata*	P3	Aug–Sep	Red sand, clay loam, loam. Undulating plains.
Acacia ataxiphylla subsp. *magna*	DRF	Jun-Jul	Sandy soils. Lateritic ironstone rises, flats.
Acacia crenulata	P3		Rocky rises, granite outcrops, breakaways.
Acacia denticulosa	DRF	Sep-Oct	Granite outcrops, rarely on sandplains.
Acacia dissona var. *indoloria*	P3	Aug-Sep	Sand, sandy loam. Undulating plains
Acacia filifolia	P3	May-Sep	Yellow sand,

Species/Taxon	Conservation Code	Flowering Period	Preferred Habitat
			gravelly lateritic sand. Sandplains.
Acacia lirellata subsp. *compressa*	P2		Yellow sand, clayey loam. Sandplains
Acacia sclerophylla var. *teretiuscula*	P1	Sep-Oct	Clay & loamy soils
Acacia undosa	P3	Jul-Sep	Undulating plains, low-lying areas.
Austrostipa blackii	P3	Sep–Nov	Unknown
Baeckea sp. *Muntadgin*	P1		Unknown
Blennospora phlegmatocarpa	P3	Sep-Oct	Sandy soils. Saline flats
Conospermum eatoniae	P3	Aug-Oct	Deep white sand, sandy clay loam
Conostylis albescens	P2	Aug	Yellow sand. Sandplains.
Dampiera scaevolina	P1	Sep-Nov	Sandy & gravelly soils.
Daviesia oxylobium	P4	Jul-Aug	Sandy lateritic soils. Undulating plains.
Dryandra shanklandiorum	P4	Jun-Aug	White/yellow sand with lateritic gravel.
Eremophila resinosa	DRF	Apr/Oct-Nov	Clay loam, gravelly sandy clay. Road verges.
Eremophila viscida	DRF	Sep-Nov	Granitic soils, sandy loam. Stony gullies, sandplains
Eucalyptus caesia subsp. *magna*	P4	May-Sep	Loam. Granite outcrops.
Eucalyptus caesia subsp. *caesia*	P4	May-Sep	Loam. Granite outcrops.
Eucalyptus cruces subsp. *crucis*	DRF	Oct-Mar	Sand, loam. Granite outcrops
Eucalyptus myriadena subsp*. parviflora*	P1		Loam. Swamps, plains
Eucalyptus subangusta subsp. *virescens*	P1	Apr	Yellow sand, white clay
Euryomyrtus leptospermoides	P3	Aug-Oct	Yellow or white sand, clayey sand, gravel. Undulating plains.
Frankenia brachyphylla	P2	Nov	Salt lake margins
Gastrolobium spectabile	P3	Sep-Nov	Sandy loam or clay loam, granite. Margins of rock outcrops.
Gastrolobium tenue	P1	Sep-Oct	Yellow sand or sandy clay. Undulating dunes,

Species/Taxon	Conservation Code	Flowering Period	Preferred Habitat
			stony outcrops.
Gompholobium asperulum	P3	Aug-Oct	Yellow sand. Undulating plains.
Grevillea asteriscosa	P4	May-Nov	Gravelly or granitic soils. Gravel rises, granite outcrops
Grevillea haplantha subsp. *recedens*	P3	Jun-Aug	Sand, sandy loam
Gunniopsis rubra	P3	Sep	Sandy loam.
Hakea aculeata	DRF	Oct	Sand, loam or clay. Road verge.
Hibbertia glabriuscula	P2	Sep	Sandplains with some laterite breakaways.
Isoetes brevicula	P3		Submerged in rock pools on granitic outcrops
Myriophyllum petraeum	P4	Aug-Oct	Strictly confined to ephemeral rock pools on granite outcrops.
Neofuscelia subimiatrix	P3		Unknown
Persoonia pungens	P3	Sep-Dec	White or yellow sand, often over laterite.
Phebalium brachycalyx	P3	Aug-Sep	Sand, gravelly soils. Lateritic uplands, hills
Scaevola tortuosa	P1	Oct	Sandy clay. Margins of salt lakes.
Symonanthus bancroftii	DRF	Sep	Unknown
Synaphea divaricata	P3	Jun-Oct	White or grey sand. Slopes, among quartzite rocks.
Thyanotus cymosus	P3	Sep-Oct	Clay, granitic or lateritic sand.
Trachymene croniniana	P3	Nov	Lateritic or loamy sand. Creek beds.
Tricoryne tuberosa (ms)	P1	Oct	Dry red-brown sand, red loam with greenstone gravel. Hilltops & gentle slopes.
Verticordia gracilis	P3	Oct-Nov	Yellow sand, gravelly sand, sandy loam.
Verticordia mitodes	P3	Oct-Jan	Yellow sand. Undulating plains
Verticordia multiflora subsp. *solox*	P2	Oct-Jan	Yellow sand over gravel, sand over granite.
Verticordia stenopetala	P3	Oct-Jan	Yellow sand, sometimes with

Species/Taxon	Conservation Code	Flowering Period	Preferred Habitat
			gravel. Undulating plains.
Vittadinia cervicularis var. *oldfieldii*	P1	Aug-Sep	Alluvium

R Declared Rare Flora: Threatened and in need of special protection.
P1 **Priority One:** Poorly Known Taxa, only a few threatened populations remaining.
P2 **Priority Two:** Poorly Known Taxa, few populations remaining, some not under threat.
P3 **Priority Three:** Poorly Known Taxa, several populations known, some not under threat.
P4 **Priority Four:** Poorly Known Taxa, rare flora, not presently threatened.

3.2.3 Vegetation Condition

The vegetation condition was described using Bush Forever's condition scale rating (Government of Western Australia, 2000) which includes six main categories ranging from Completely Degraded to Pristine. The condition categories relevant to the study area are described below:

Excellent – Some relatively slight signs of damage caused by the activities of European, for example, disturbance caused by repeated fires and the presence of non-aggressive weeds.

Very Good – Vegetation structure altered, obvious signs of disturbance. For example, disturbance caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing

Good – Vegetation structure significantly altered by very obvious signs of multiple disturbances. Vegetation retains basic structure or ability to regenerate it, for example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

Degraded – Basic vegetation structure severely impacted by disturbance. There is scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

Completely Degraded – The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with flora composing weed or crop species with isolated native trees or shrubs.

3.2.4 Significant Trees

Tree species were identified within the route and the following attributes recorded on the 12th July 2006 to provide data to rank their significance - species, height, circumference at breast height (CBH) and approximate distance from the road edge (north or south). The trees were then prioritised utilising a ranking system tabled in Appendix 1 to determine their significance.

Western Australia provides no legislative protection for significant trees and the National Trust of Western Australia's tree register is now closed. However reference was made to definitions and legislation used by the National Trust of South Australia (*The Development Act 1993*). The National Trust of South Australia considers trees to be Significant if they are outstanding and therefore deserving of special protection because of their rarity, appearance, natural or cultural importance. This may be on the

basis of outstanding age, size and aesthetic merit, connection to an important historic event, scientific value, Aboriginal importance or occurrence in a unique location or context. Significant trees generally have a trunk circumference of 2.0m or more at a point 1.0m above the ground (trees with multiple trunks are also covered by the legislation).

Tree and vegetation data was annotated on the design plans to assist in determining an alignment that minimised impacts to the environment.

3.2.5 Vegetation Complexes

The project area lies within the South West Botanical Province, Avon Botanical District and Muntadgin Vegetation System (Pate and Beard, 1984). This area is also defined as the Avon Wheatbelt Biogeographic Region, sub-region AW1 in which less than 20% of the original vegetation remains (DEH, 2001).

The DEH (2001) estimated that the Shire of Merredin supports 11.8% of the original vegetation. Approximately 8.2% of the remnant vegetation in the wheatbelt is protected within CALM conservation estate (DEH, 2001). More than 70% of the *Eucalyptus salmonophloia* and *Eucalyptus salubris* Medium Woodlands have been cleared since European settlement (Department of Agriculture, Technical Report 249) and it has been estimated that only 9.4% is extant in the Avon River Basin (Avon Catchments Council, 2005). The remnant vegetation in this region is highly fragmented (Dunne and Caccetta 2001).

Two vegetation associations identified by Beard (1980) in 1:250,000 scale mapping are located within DP 8 on the Agriculture WA Shared Land Information Platform (SLIP) spatial database (www.agric.wa.gov.au/slip). Beeston et al (2002) provides estimates of how much of these associations persist since clearing for European settlement of Western Australia (Table 6).

TABLE 6
VEGETATION TYPES, DESCRIPTION AND PRE-EUROPEAN EXTENT

Beeston et al (2002) Association	Description	Current Extent (ha)	Percentage Pre-European Vegetation Remaining (ha remaining)
36	Muntagin: shrublands; thicket, Acacia	157.048	49.74
1055	Muntagin: shrublands; York Gum and *Eucalyptus sheathiana* mallee scrub	13,503	10.7

3.2.6 Vegetation Types and Condition

The total area of DP 8 is 4.345 ha, of which 1.1825 ha has been extensively modified due to clearing for gravel pits and access tracks, however approximately 3.1625 ha of the vegetation is in Good to Excellent Condition. A total of three principle vegetation types were identified, which are described below.

LOWEsEsEl

Low Open Woodland dominated by *Eucalyptus salmonophloia, Eucalyptus salubris* and *Eucalyptus loxophleba* subsp. *lissophloia* with occasional *Casuarina obesa* over a Tall Shrubland to 2m dominated by *Acacia acuminata, Acacia hemiteles* and *Acacia assimilis* subsp. *assimilis* over a Herbland dominated by *Atriplex bunburyana* over a Grassland dominated by *Avena fatua*.

SAgAn

Shrubland to 2m dominated by *Acacia ?gibbosa* and *Acacia neurophylla* subsp. *erugata* with occasional *Eucalyptus erythronema* var. *erythronema* over a Low Open Shrubland to 1m dominated by *Melaleuca cordata* and *Grevillea paradoxa* with occasional *Grevillea didymobotrya* subsp. *didymobotrya* over an Open Grassland of *Avena fatua* and *Eragrostis curvula* over an Open Herbland dominated by *Waitzia acuminate*

LWAcAh

Tall closed scrub to Tall shrubland of *Allocasuarina campestris* and *Allocasuarina huegeliana* with occasional *Santalum acuminatum* over Scattered tall shrubs *Acacia* spp. including *Acacia neurophylla* subsp. *erugata* over Scattered Shrubs of Astroloma serratifolium, Phebalium tuberculatum and *Isopogon scabriusculus*. over Scattered *Lepidosperma brunonianum* and *Drosera* sp. (rosettes).

The vegetation types and condition ratings for vegetation within DP 8 are shown in Table 7. The majority of the vegetation was in Good to Very Good Condition (Table 7). All of the cleared areas (1.1825 ha) were classified as Completely Degraded in condition.

TABLE 7
VEGETATION TYPES, AREA AND CONDITION ALONG DP 8

Section (SLK) [new SLK]	Design package	Vegetation Type	Condition Rating	Area (ha)	Vegetation Association Beeston et al (2002)
264.3 to 264.6	8 (GEH)	SAgAn	G	0	1055
264.6 to 264.8	8 (GEH)	SAgAn	G	0.25	36
[264.8 to 265.33]	8 (Realignment)	SAgAn	G - Vg	1.125	36
[265.32 to 265.34]	8 (Realignment)	LOWEsEs El	G	0.2	36
[265.34 to 265.68]	8 (Realignment)	LWAcAh	VG-E	0.85	36
[265.68 to 265.77]	8 (Realignment)	LWAcAh	VG - E	0.1125	36
[265.68 to 265.77]	8 (Realignment)		CD	0.1125	36
{265.77 – 265.88]	8 (Realignment)		CD	0.22	36
[265.76 to 265.88]	8 (Realignment)	LWAcAh	VG	0.055	36
[265.88 to 266.2]	8 (Realignment)	LWAcAh	G - VG	0.16	36
[266.2 to 266.3]	8 (Realignment)		CD	0.25	36
[266.3 to 266.5]	Parking Area	SAgAn	G	0.6	36
[266.5 to 266.58]	Parking Area		CD	0.6	36
[266.58 to 266.69]	8 (Realignment)	SAgAn	D - G	0.22	36

E = vegetation in excellent condition VG = vegetation in very good condition G = vegetation in good condition
D = vegetation in degraded condition CD = vegetation in completely degraded condition

3.2.7 Flora

Areas that have been impacted by gravel extraction operations and associated access are classified as Completely Degraded, with very few species of native flora remaining. A total of 89 plant species (79 native and 10 introduced) were recorded from within remnant vegetation in the road reserve and realignment area (Appendix 2). The families with the greatest representation within the study area were the Myrtaceae (15 taxa) and Proteaceae (12 taxa) families.

A total of 10 introduced (weed) species were recorded from DP 8 including *Avena fatua, Ehrharta calycina, Briza maxima, Bromus diandrus, Cynodon dactylon*, *Eragrostis curvula, Limonium sinuatum* and *Rhaphanus rhaphanistrum*.

3.2.8 Significant Vegetation

A search of the Department of Conservation and Land Management's (CALM) Threatened Ecological Community (TEC) database found no known occurrences of TECs within the study area. No inferred TEC's were recorded within DP 8.

It is proposed to clear approximately 1.475ha of SAgAn and approximately 1.225ha of LWAcAh. Both of these vegetation types correspond to the *Acacia-Casuarina* thickets on sandplain described by Beard (1980). LWAcAh supports taxa analogous with Vegetation Assemblage 22 described by Gibson et al (2004), namely *Allocasuarina campestris, Astroloma serratifolium* and *Borya constricta*.

The remainder of the vegetation to be cleared (0.2ha) is described as LOWEsEsEl, a Low Open Woodland dominated by *Eucalyptus salmonophloia*, *Eucalyptus salubris* and *Eucalyptus loxophleba* subsp. *lissophloia* with occasional *Casuarina obesa* over a Tall Shrubland to 2 m dominated by *Acacia acuminata, Acacia hemiteles* and *Acacia assimilis* subsp. *assimilis* over a Herbland dominated by *Atriplex bunburyana*. This vegetation association is the most common vegetation type (approximately 70%) adjacent to Great Eastern Highway between Hines Hill and Walgoolan. This community is also represented in the A Class Reserve 23580, located approximately 3km east of Merredin.

The LOWEsEsEl, SAaAh and LWAcAh communities approximately resemble Beard Vegetation Association 36 and Vegetation Association 1055. Vegetation Association 36 is described as Shrublands thicket, *Acacia, Allocasuarina* alliance ?species. The pre-European extent of Vegetation Association 36 is estimated at 315,743ha, of which 49.74% remains. Vegetation Association 1055 is described as Shrublands; York Gum and *Eucalyptus sheathiana* mallee scrub. The pre European extent of Vegetation Association 1055 is estimated at 126,196ha, of which 10.7% remains (Beeston et al, 2002; CALM, 2003b). None of the vegetation associated with Vegetation Association 1055 will be cleared for DP8 (Table 7).

Detailed mapping of Wheatbelt vegetation is yet to be completed as part of the State Salinity Strategy, however CALM (2003a) estimated that less than 2% of the vegetation in the Avon Wheatbelt has been incorporated into a comprehensive, adequate and representative reserve (CAR) system.

A search of the Department of Conservation and Land Management Declared Rare and Priority Flora database was undertaken to identify significant flora which have been recorded in the vicinity of the study area (CALM, 2005).

The CALM (2005) database search identified a total of seven DRF, nine Priority 1 species, five Priority 2 species, twenty three Priority 3 and six Priority 4 species occurring in the vicinity of the Aline East project area.

No Declared Rare or Priority species were recorded during the assessment of DP 8.

3.2.9 Significant Trees

Four trees rated as having Very High Significance are located within the clearing envelope of DP8. One tree is located on the north side of GEH at SLK 264.3 and three within the realignment area south of SLK 265.4. There are several trees rated as Medium Significance nearby and one near SLK 264.35 (realignment SLK). A list of the trees evaluated for significance within DP 8 is included in Appendix 3.

Four trees rated as having Very High Significance will be cleared for the project. Three *Eucalyptus salmonophloia* trees rated as having Medium Significance will also be cleared for the realignment.

3.2.10 Dieback

The dieback species *Phytophthorra cinnamomi* was probably introduced by European settlers in 1828 with plant stock of domestic fruit trees (Podger, et al., 1996 and 1999). It is considered that areas most vulnerable to the pathogen are confined to the parts of the SW Land Division with rainfall isohyets of at least 600mm.

Phytophthorra cinnamomi has not been recorded east of Northam on the Great Eastern Highway (Dieback Working Group and Threatened Species Network, 2005).

3.3 Fauna

3.3.1 Methodology

A Level 1 fauna assessment of the study area was conducted from 31 October to 2 November 2005. The methodology follows that described in the *Environmental Protection Agency* (EPA) *Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004). This Level 1 fauna assessment consists of three components:

a. desktop study which includes a literature review and a search of the relevant databases;
b. reconnaissance survey to verify the desktop survey and to delineate fauna values present in the area; and
c. targeted search for significant feeding and breeding sites for Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*).

3.3.2 Database Searches

A search of the Western Australian Museum on-line database (FaunaBase) was undertaken to develop a list of potential birds, reptiles, mammals and amphibians in the study area. The search area was bounded by latitude 31°30' to 31°45'S, and longitude 117°30' to 118°12'E.

Data from FaunaBase supplemented with information from other surveys conducted in the general region and the consultant's personal experience of the area. Specific surveys reviewed included Muir *et al.* (1978), Smith *et al.* (1997) and Chapman and Dell (1985).

Potential Scheduled and Threatened Fauna species in the study area were identified by searches of the Department of Conservation and Land Management's (CALM) Threatened and Priority Species database and the Commonwealth Department of Environment and Heritage's (DEH) *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* on-line database (Appendix 4).

Taxonomy and nomenclature for fauna species used in this report follow FaunaBase which follows Aplin and Smith (2001) for amphibians and reptiles, How et al. (2001) for mammals and Johnstone and Storr (1998; 2004) for birds.

3.3.3 Site Assessment

A site visit conducted by Dr Jessica Oates to examine the available fauna habitat for amphibians, reptiles, mammals and birds was undertaken from 31 October to 2 November 2005. No fauna trapping was conducted as part of this assessment. This survey was used specifically to identify any suitable tree hollows that may be used for breeding by Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*).

The weather throughout the survey period was fine with occasional cloud, and warm.

3.3.4 Fauna Habitat

The majority of the native vegetation within the area proposed for the realignment is in Good to Excellent Condition and the vegetation on the section of GEH proposed to be widened and tied into the realignment supports more degraded vegetation in Degraded to Good Condition. Three major fauna habitat types were identified corresponding to the vegetation types described in Section 3.2.6.

3.3.5 Avifauna, Reptiles, Amphibians and Mammals

The assessment predicted that the habitats within DP 8 could potentially support 7 amphibians, 46 reptiles, 110 birds and 27 mammals (including 9 introduced mammals) (Appendix 5). However, not all of these species will be necessarily present because of the absence of specific micro-habitat requirements and the large database search area.

No reptiles or mammals were noted in the Design Packages during the survey. The weather was fine; however it may still have been too cool for some reptiles.

3.4 Significant Fauna

The fauna species listed in Table 8 have special status in either State or Commonwealth government legislation or are on the CALM Priority Species list. They were highlighted as being potentially present after searching the CALM and EPBC records for the region and matching those with the available faunal records for the area.

TABLE 8
SIGNIFICANT VERTEBRATE SPECIES RECORDED OR LISTED AS POTENTIALLY OCCURRING WITHIN THE VICINITY OF DP 8

Species	Status under Wildlife Conservation Act Schedule/ Priority	Status under Commonwealth Environment Protection and Biodiversity Act	Comment
Western Spiny-tailed Skink *Egernia stokesii badia*	Schedule 1	Endangered	Unlikely to occur within the area
Carnaby's Black-Cockatoo *Calyptorhynchus latirostris*	Schedule 1	Endangered	Likely to occur within the area, but unlikely to utilise the area for breeding purposes
Chuditch *Dasyurus geoffroii*	Schedule 1	Vulnerable	Unlikely to occur within the area
Malleefowl *Leipoa ocellata*	Schedule 1	Vulnerable	May occur within the area
Tree-stem Trapdoor Spider *Aganippe castellum*	Schedule 1		May occur within the area
Carpet Python *Morelia spilota imbricata*	Schedule 4		May occur within the area
Peregrine Falcon *Falco peregrinus*	Schedule 4	Migratory	Unlikely to rely on the area for survival although regionally present
Cricket *Ixalodectes flectocercus*	Priority 1		May occur within the area
Western Brush Wallaby *Macropus irma*	Priority 4		Highly unlikely to occur within the area due to unsuitable habitat
Crested Bellbird *Oreoica guttaralis guttaralis*	Priority 4		Unlikely to occur within the area
Bush Stone-curlew *Burhinus grallarius*	Priority 4		May occur within the area
White-browed Babbler *Pomatostomus superciliosus ashbyi*	Priority 4		May occur within the area
Rainbow Bee-eater *Merops ornatus*		Migratory	Unlikely to rely on the area for survival although regionally present
Fork-tailed Swift *Apus pacificus pacificus*		Migratory	Unlikely to rely on the area for survival although regionally present

Western Spiny-tailed Skink (*Egernia stokesii badia*) – The Western Spiny-tailed Skink occurs in semi-arid scrubs and woodlands of Shark Bay and the northern Wheatbelt, sheltering in hollow logs, behind the bark of fallen trees and old abandoned buildings. Specimens of the Western Spiny-tailed Skink have been collected previously from

localities in the central Wheatbelt. However, a survey of sites within the central Wheatbelt including Kellerberrin did not reveal any current presence of this species (How et al., 2003). The Western Spiny-tailed Skink is unlikely to be found in habitat within DP 8 as the area is at the southern limit of its range. No evidence of this species was found during the site assessment.

Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) - This species inhabits the south-west of Western Australia. Its preferred habitat is the woodland where it preferentially feeds on plants of the Proteaceae family. Preferred nesting trees include, the smooth-barked Salmon Gum (*Eucalyptus salmonophloia*), which contain deep hollows (Johnstone and Storr, 1998). Nesting also occurs in Marri (*Corymbia calophylla*) and Tuart (*E. gomphocephala*). Carnaby's Black-Cockatoos may utilise some of the Eucalypt trees for feeding within DP 8. However, no Black-Cockatoos were sighted during the site assessment. The *Eucalyptus* trees within DP 8 did not contain any suitable hollows to support breeding Black-Cockatoos and therefore, Carnaby's Black-Cockatoo is unlikely to rely on the area for breeding purposes.

Chuditch (*Dasyurus geoffroii*) – The Chuditch is formally known from over 70% of Australia, however, the Chuditch now has a patchy distribution throughout the Jarrah forest and mixed Karri/Marri/Jarrah forest of south-west Western Australia. Chuditch are solitary animals for most of their life. Habitat alteration and removal of suitable den logs and den sites following land clearing, grazing and frequent wildfire have contributed to a decline in Chuditch numbers. Competition for food and predation by foxes and cats, hunting and poisoning have also contributed to its decline. The Chuditch is unlikely to occur within DP 8 due to the small size of remnant vegetation areas remaining and their lack of connectivity.

Malleefowl (*Leipoa ocellata*) – Malleefowl are large, ground-dwelling birds that rarely fly unless alarmed. Historically, Malleefowl have been found in mallee regions of southern Australia from approximately the 26th parallel of latitude southwards. Recently the range has contracted due to fox predation and land clearance. However, Malleefowl are still found throughout these regions in fragmented patches. Malleefowl are threatened Australia wide. Clearing of habitat for agriculture, increased fire frequency, competition with exotic herbivores (sheep, rabbits, cattle, goats) and kangaroos, predation by foxes and cats, inbreeding as a result of fragmentation and possibly hunting for food in marginal populations are all threatening processes. The denser thickets of vegetation in DP 8 are suitable for Malleefowl however their size and fragmentation may preclude this species.

Tree-stem Trapdoor Spider (*Aganippe castellum*) – This species lives in summer dry bogs prone to irregular flooding and builds a characteristic burrow entrance against a tree stem. Evidence of this species was recorded from Merredin in 2004 and it may occur within DP 8.

Carpet Python (*Morelia spilota imbricata*) – The Carpet Python is a large snake found across the south-west of Western Australia, north to Geraldton and Yalgoo, and east to Kalgoorlie, Fraser Range and Eyre. It inhabits forest, heath or wetland areas and shelters in hollow logs or in branches of large trees. Carpet Pythons are often found in colonies, particularly during the breeding season in spring. This species is widespread within the south-west of WA, but is not in high density across its distribution. This species may occur within the vegetated parts of DP 8.

Peregrine Falcon (*Falco peregrinus*) – The Peregrine Falcon is uncommon, although widespread throughout much of Australia excluding the extremely dry areas and has a wide and patchy distribution. It shows habitat preferences for areas near cliffs along coastlines, rivers and ranges and within woodlands along watercourses and around lakes. It favours hilly or mountainous country and open woodlands and may be an occasional visitor to the study area. This species may be a transient visitor to the DP 8 areas.

Ixalodectes flectocercus – This species of cricket was thought to be extinct until it was rediscovered at two sites in 1999. The holotype was collected from Beverley and the other site was Nokaning just north of the search area. It could possibly occur in the DP 8 areas.

Western Brush Wallaby (*Macropus irma*) - This species was very common in the early days of settlement, however, its range has been seriously reduced and fragmented due to clearing for agriculture and there is a significant decline in abundance within most remaining habitat. It is now distributed across the south west of Western Australia from north of Kalbarri to Cape Arid. The optimum habitat is open forest or woodland, particularly favouring open seasonally wet flats with low grasses and open scrubby thickets. This species is highly unlikely to occur due to unsuitable habitat within DP 8.

Crested Bellbird (*Oreoica gutturalis*) – The Crested Bellbird has disappeared from well in excess of 50% of its historical range, particularly along the periphery. The Southern Crested Bellbird is now found towards the inland in south-western Australia, South Australia, Victoria, New South Wales, and Queensland. Crested Bellbirds live in the shrub-layer of eucalypt woodland, mallee, acacia shrubland, *Triodia* hummock grassland, saltbush and heath, where they feed on a variety of insects and seeds. The Crested Bellbird has been eliminated from much of its former range by clearing. It seems particularly sensitive to subsequent fragmentation, with areas of apparently suitable habitat as large as 5000ha now unoccupied. This species was recorded from Carrabin Nature Reserve in 1982.The Crested Bellbird is unlikely to be found within DP 8 due to the highly fragmented nature and small size of the remnant vegetation.

Bush Stone-curlew (*Burhinus grallarius*) – The Bush Stone-curlew is a large, slim, mainly nocturnal, ground-dwelling bird. It is regarded as uncommon or rare having declined as a result of feral cats and foxes. It can be found in open wooded country or scrubs, and in many other habitats. The Bush Stone-curlew is an uncommon resident of the Wheatbelt woodlands. The Bush Stone-curlew potentially occurs within DP 8.

White-browed Babbler (*Pomatostomus superciliosus ashbyi*) – This subspecies lives in Eucalyptus forest and woodland, foraging on or near the ground for insects and seeds. Clearance for agriculture has removed most of this species' habitat in the wheatbelt of Western Australia. Continuing declines are inevitable, even though the subspecies is still widespread and is more persistent in fragments than other wheatbelt taxa. The White-browed Babbler may occur within DP 8 although there is limited woodland present.

Rainbow Bee-eater (*Merops ornatus*) – This species is found across the better-watered parts of Western Australia including islands. It prefers lightly wooded, preferably sandy, country near water. It is a resident, breeding visitor, postnuptial nomad, passage migrant and winter visitor, wintering from the Gascoyne north to Indonesia. It moves south mainly in late September and early October and north from February to April. It is scarce to very common across its range. Although this species

may be present within the region during the migratory period it is unlikely to rely on the site.

Fork-tailed Swift (*Apus pacificus pacificus*) – This species breeds in the north-east and mid-east Asia and winters in Australia and southern New Guinea. It is a visitor to most parts of Western Australia, beginning to arrive in the Kimberley in late September, in the Pilbara and Eucla in November and in the south-west land division in mid-December, and leaving by late April. It is common in the Kimberley, uncommon to moderately common near north-west, west and south-east coasts and rare to scarce elsewhere. Although this species may be present within the region it is unlikely to rely on the site.

3.4.1 Species of National Environmental Significance

Species Potentially Occurring within DP 8 Identified as Being of National Environmental Significance under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*)

Four threatened species of fauna and three migratory species of birds listed as potentially occurring within the vicinity of DP 8 were identified under the *Environment Protection and Biodiversity Conservation Act 1999* as having national environmental significance (Table 8). Of these only Carnaby's Black-Cockatoo, listed as Endangered and the three migratory species Peregrine Falcon, Rainbow Bee-eater and Fork-tailed Swift are expected to be in the study area.

3.4.2 Threatened or Priority Species

Threatened or Priority Species under the WA Wildlife Conservation Act 1950-1979 That Were Listed as Being Potentially Found within DP 8

In Western Australia, all native fauna species are protected under the WA Wildlife Conservation Act 1950-1979. Fauna that are considered rare, threatened with extinction, or have a high conservation value are specially protected under the WA Wildlife Conservation Act 1950. In addition, some species of fauna are covered under the 1991 ANZECC convention, while certain birds are listed under the Japan and Australian Migratory Bird Agreement (JAMBA) and the China and Australian Migratory Bird Agreement (CAMBA).

Threatened and Priority species listed under the WA Wildlife Conservation Act 1950 and present on lists generated for the area by searching FaunaBase are shown in Table 8. Included are five Schedule 1 species, two Schedule 4 species, one Priority 1 species and four Priority 4 species.

3.4.3 Biodiversity Value at Genetic, Species and Ecosystem Levels

It is likely that species of mammals, reptiles, birds and amphibians predicted to be found in DP 8 would also occur in less fragmented and larger vegetated areas such as the A Class Reserve land to the west. The remnant vegetation within DP 8 is in relatively Good to Excellent condition and the leaf litter indicates that it is long unburnt. However the remnant vegetation is highly fragmented. Old gravel extraction pits, access tracks and farmland surround the remnant vegetation.

The Carnaby's Black-Cockatoo may utilise the small remnants of vegetation for feeding as there is a wide mixture of flowering shrubs. The trees rated as having High and Very High significance within DP 8 did not support hollows of adequate size to support Carnaby's Black Cockatoos. This proposal therefore is not expected to impact significantly on this species.

The other species of conservation significant fauna likely to be present within DP 8 are the Peregrine Falcon, White-browed Babbler, Carpet Python, Fork-tailed Swift and Rainbow Bee-eater. Given the minimal and linear nature of the clearing, it is unlikely to substantially modify, destroy or isolate an area of important habitat for these species, or seriously disrupt the lifecycle of an ecologically significant proportion of the population of any of these species.

The clearing of vegetation has the potential to have a direct impact on fauna and faunal assemblages in the short term, although it is unlikely to have a significant impact on the biodiversity value at the genetic, species and ecosystem levels in this region.

3.4.4 Ecological Functional Value at the Ecosystem Level

There were no special features or specific habitats within DP 8 that would indicate it possesses ecological functions that are significantly different to many other areas in the region. The remnant vegetation is in Good to Excellent Condition and thus may provide some habitat for fauna; however it is fragmented and thus unlikely to support significant numbers of fauna, particularly any conservation significant species. However, the road reserve provides an important refuge for fauna species in an otherwise cleared habitat. Any further loss of this vegetation would result in a reduction in the already limited amount of habitat connectivity along the road reserves.

3.5 Aboriginal Heritage

A survey of the archaeological and ethnological significance of the site was undertaken in 1994 (McIntyre *et al* 1994). A desktop review was undertaken to determine the need for further consultation in DP 8 and it was considered not necessary due to the degraded nature of the land within these design packages (Quartermaine, 2006).

3.5.1 Archaeological

No known Aboriginal sites of archaeological significance appear on the Department of Indigenous Affairs (DIA) Aboriginal Site Register as occurring within 500m of the existing pavement within DP 8. Field and desktop investigations of Great Eastern Highway between Cunderdin (153.8 SLK) and Walgoolan (288.2 SLK) failed to locate any archaeological sites of significance to living Aboriginal people (MacIntyre et al 1994). Aboriginal sites registered on the Department of Indigenous Affairs database on the 22nd December 2005 are included in Appendix 5.

No Aboriginal cultural material was discovered from the current road reserve in previous surveys and it is considered unlikely in light of the level of degradation of the project area. Aline East is committed to reporting any suspected material uncovered during construction to the Department of Indigenous Affairs.

3.5.2 Ethnographic

Considering the nature of the vegetation and level of disturbance within DP 8, the ethnographic surveys conducted in 1994 (MacIntyre et al 1994) and the desktop review (Quartermaine, 2006) were deemed adequate to ensure that no Aboriginal ethnographic values were affected by the proposed works.

3.6 European Heritage

There are no places within DP 8 that are listed on the Merredin Municipal Inventory (78/30) (February 1999) or the Heritage Council of Western Australia's Register of Heritage Places database (http://register.heritage.wa.gov.au/).

There are no places of natural, indigenous or historic heritage value listed on the Commonwealth Heritage list (www.deh.gov.au/heritage/commonwealth/wa.html) or the Heritage Council of WA's Register of Heritage Places within or adjacent to DP 8.

3.7 Contaminated Sites

The Shire of Merredin currently does not have a list of "potentially contaminated sites" (Warren Bow pers. comm. 2005). There are no apparent contaminated sites within DP 8.

3.8 Noise

Herring Storer Acoustics (2006a and 2006b) undertook an acoustic assessment of DP 8 to determine the impact of future road traffic noise levels received at residences located adjacent to these packages (Appendix 7).

An assessment of acceptable road traffic noise has been made in accordance with Main Roads *Noise Level Objectives*. Main Roads objectives cite an $L_{10,18hour}$ value of 63 dB(A) as being acceptable.

The Western Australian Planning Commission (WAPC) in May 2005 released a Draft Planning Policy for Road and Rail Transport Noise. The appropriate criteria in this case would be Noise Exposure 2, which cites the following noise limits:

Day	L_{Aeq} 60
Night	L_{Aeq} 55

Predictions were made for noise received at the two residences located adjacent to the proposed road modifications (Table 9).

TABLE 9
CALCULATED $L_{A10,(18HR)}$ NOISE LEVEL

Locations	Calculated $L_{A10,(18hr)}$ dB(A)	
	Current	Year 2025
L1 – North of Proposed Alignment	51 (190m)	57 (70m)
L2 – South of Proposed Alignment	47 (450m)	53 (150m)

( ) Approximate distance between proposed alignment and residence

From extensive monitoring carried out on similar roads, the difference between the $L_{10,18hour}$ and $L_{eq,16hour}$ (day period) and between the $L_{10,18hour}$ and $L_{eq,8hour}$ (night period) are approximately 3 and 9 dB(A) respectively. To calculate the current and future $L_{eq,16hour}$ and $L_{eq,8hour}$ it has been assumed that this same difference will exist in the current traffic flows and the year 2025. The resultant $L_{eq,16hour}$ (day period) and $L_{eq,8hour}$ (night period) are listed in Table 10

TABLE 10
CALCULATED $L_{eq,(16hr)}$ AND $L_{eq,(8hr)}$

Location	Calculated Noise Level, dB(A)			
	(Day Period)		(Night Period)	
	Current	Year 2025	Current	Year 2025
L1 – North of Proposed Alignment	48	54	42	48
L2 – South of Proposed Alignment	44	50	38	44

Note: Calculation includes +2.5 dB(A) façade correction.

Based on the acoustical assessment, it is predicted that noise received at noise sensitive premises located adjacent to the road modifications in DP 8 will comply with the Main Roads noise level objectives and the WAPC Draft Planning Policy for Road and Rail Transport Noise up to and including the year 2025. No noise amelioration is therefore required.

3.9 Visual Amenity

The will be little change to the visual amenity of DP 8 with the realignment. The road reserve supports relatively dense shrubland on the south side and slightly more degraded shrubland on the north side of the existing road. There are very few large trees other than *Allocasuarina* sometimes growing in dense groves up to 8m tall.

4. ENVIRONMENTAL ASPECTS AND IMPACTS

Construction of DP 8 has the potential to have direct and indirect impacts on the biophysical and social environment associated with the upgrading of Great Eastern Highway.

Table 10 provides a summary of all of the biophysical, pollution management and social surrounding related environmental aspects associated with the project, including the likely EPA objectives, potential impacts and management and predicted outcomes, while the principal environmental constraints associated with the Section are diagrammatically presented in Figures 2a-d. The "Potential Impact" is the maximum impact associated with the project without any cognisance of impacts during the design or management during construction, while "Predicted Outcome" refers to the most likely actual maximum impact.

The construction of DP 8 in relation to the ten principles for the clearing of native vegetation in the *Environmental Protection Act 1986* Schedule 5 and in the Main Roads Project Purpose Permit (1st February 2006) is also described in Table 11.

TABLE 11
GREAT EASTERN HIGHWAY UPGRADE – SUMMARY OF ENVIRONMENTAL FACTORS FOR DP 8

FACTOR	LIKELY EPA OBJECTIVE	EXISTING ENVIRONMENT	POTENTIAL IMPACT	ENVIRONMENTAL MANAGEMENT	PREDICTED OUTCOME
Biophysical:					
Environmentally Sensitive Areas	To minimize impacts on environmentally sensitive areas (ESAs)	No environmentally sensitive areas occur within the project area	na	Project Environmental Management Plan will limit direct and indirect impacts on the environment	No impacts on Environmentally sensitive areas
Vegetation communities and Flora	To maintain the abundance, species diversity, geographic distribution and productivity of vegetation of flora at species, ecosystem and community level through the avoidance or management of adverse impacts and improvement in knowledge.	The realignment section of DP 8 has been affected by clearing and gravel extraction; however there are pockets of intact remnant vegetation in Good to Excellent Condition. CALM's Threatened (Declared Rare) or Priority Flora database (Table 5) identified 50 species of conservation significance (DRF and Priority species) in the vicinity of DP 8. None were recorded during the flora and vegetation assessment.	Clearing of 3.1625 ha of remnant vegetation for road construction.	Significant trees and remnant vegetation was identified and incorporated into the design as much as practicable. Disturbed areas will be revegetated. Only weed-free vegetation and topsoil is to be re-used for rehabilitation.	Loss of 3.1625 ha of remnant vegetation. Loss of four trees rated as having Very High Significance.

FACTOR	LIKELY EPA OBJECTIVE	EXISTING ENVIRONMENT	POTENTIAL IMPACT	ENVIRONMENTAL MANAGEMENT	PREDICTED OUTCOME
Wetlands	To maintain the integrity, ecological functions and environmental values of wetlands	No wetlands within DP 8.	None on wetlands.	The Environmental Management Plan will limit direct and indirect impacts through surface water drainage movement and erosion.	No impacts on wetlands
Fauna	Significant Fauna species and their habitats, consistent with the provisions of the *Wildlife Conservation Act 1950.*	DP 8 contains habitats that have being modified to some extent and are unlikely to support Significant Fauna. A review of 'Faunabase' and CALM's Threatened and Priority Fauna list indicates several significant species are likely to occur in the project area between Kellerberrin and Carrabin: • *Calytorhynchus latirostris* (Carnaby's Black Cockatoo (Schedule 1) – recorded in Kellerberrin in the 1960's • Several other significant species may occur within the area: • *Aganippe castellum* (Tree-stem Trapdoor Spider) (Schedule 1); • *Morelia spilota imbricata* • (Carpet Python)	Carnaby's Black Cockatoo has been recorded breeding at Kellerberrin in the 1960's although no cockatoos or suitable hollows were located during surveys of DP 8 and therefore the project is unlikely to impact this species. The realignment and widening will require the clearing of trees that may have eventually supported Carnaby's Black Cockatoo however this has been minimised in the design packages by taking into account significant trees, particularly *Eucalyptus salmonophloia* and native vegetation. There was no evidence	Significant potential habitat trees and remnant vegetation incorporated into design planning constraints. Clearing of vegetation and significant trees that may contain nesting habitats, provide food resource and corridors for fauna minimised. Remnant vegetation and modified vegetation enhanced through supplementary planting where possible to increase total size of vegetated areas.	Clearing of approximately 3.1625 ha of potential fauna habitat. Other than general loss of some habitat and possible reduced habitat connectivity as a result of clearing of native or planted vegetation, the upgrade or widening of the highway will result in the loss of a small number of potential nesting sites in the future. No existing hollows suitable for Carnaby's Black Cockatoo will be lost.

FACTOR	LIKELY EPA OBJECTIVE	EXISTING ENVIRONMENT	POTENTIAL IMPACT	ENVIRONMENTAL MANAGEMENT	PREDICTED OUTCOME
		(Schedule 4); • *Ixalodectes flectocercus* (Cricket) (Priority 1); • *Burhinus grallarius* (Bush Stone-curlew) (Priority 4); and • *Pomatostomus superciliosus* (White-browed Babbler) (Priority 4). None of these species were recorded during the fauna assessment of the section.	of the other significant species that may occur in DP 8.		
Pollution Management					
Surface Water Quality	Maintain or improve the quality of surface water to ensure that existing and potential users, including ecosystem maintenance, are protected and consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA 1993) and the NHMRC/ARMCANZ Australian Drinking Water Guidelines – National water Quality Management	Relatively flat land with minimal drainage.	There is low potential for impact on the surface water quality due to the nature of the road making process and products being utilised for construction.	The Environmental Management Plan will address the issue of drainage, erosion and contaminant management	Drainage, contaminated water control and rehabilitation will ensure no direct impact on the catchment.

FACTOR	LIKELY EPA OBJECTIVE	EXISTING ENVIRONMENT	POTENTIAL IMPACT	ENVIRONMENTAL MANAGEMENT	PREDICTED OUTCOME
	Strategy.				
Noise	Protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring that noise levels meet Aline East's Noise Level Objectives and the *Environmental Protection (Noise) Regulations 1997* and the *Draft Planning Policy on Road and Rail Transport Noise.*	The existing noise levels due to traffic within DP 8 are considered to be in "high ambient" areas.	The proposed upgrade of Great Eastern Highway through DP 8 is predicted to comply with the Main Roads WA "Noise Level Objectives" and the *Draft Planning Policy on Road and Rail Transport Noise.*	- Ensure noise level emissions are in accordance with criteria set by Main Roads WA and DEP. - Despite adherence to the *Draft Planning Policy on Road and Rail Transport Noise* a noise bund will be constructed to minimize noise impacts. - No vibrating rollers will be used within 100 metres of private properties or outside of hours prescribed in the Noise Management Plan. -The Environmental Management Plan will address the issue of construction noise and vibration.	Predicted Noise levels associated with upgrading the road in DP 8 comply with Main Roads WA criteria and *Draft Planning Policy on Road and Rail Transport Noise*.
Social Surroundings					
Aboriginal Heritage	(i) Ensure that the proposal complies with the requirements of the Aboriginal Heritage Act, 1972. (ii) Ensure that changes to the biological and physical	No ethnographic or archaeological sites were identified by any of the Aboriginal consultants within the road reserve or areas to be incorporated into the road reserve along this section of the Great	No sites of ethnographic or archaeological significance in the Shire of Merredin will be directly impacted by the proposal.	Where suspected Aboriginal heritage values or sites are encountered work will cease until a qualified Heritage specialist has inspected the site.	No direct impact on sites of Aboriginal cultural significance

FACTOR	LIKELY EPA OBJECTIVE	EXISTING ENVIRONMENT	POTENTIAL IMPACT	ENVIRONMENTAL MANAGEMENT	PREDICTED OUTCOME
	environment resulting from the project do not significantly adversely affect cultural associations with the area, or historical significance.	Eastern Highway.	Work will cease on any sections of road where suspected Aboriginal heritage values or sites are encountered until a qualified Heritage specialist has inspected the site.	Desktop and previous field surveys have confirmed that no Aboriginal sites will be impacted by DP 8.	
European Heritage European Heritage	Ensure that the proposal complies with the *Heritage of Western Australia Act 1990.*	There are no registered heritage sites occurring in areas adjacent to DP 8 of the proposed upgrade.	No historical sites have been recorded within or adjacent to DP 8. These areas have been subjected to significant disturbance and therefore it is unlikely that there will be any further significant impacts to historical values.	If any evidence of European heritage is discovered during construction, works will cease in that area until a suitably qualified archaeologist is commissioned to make an evaluation of its significance.	No impacts to European heritage are predicted.
Visual Amenity	Visual amenity of the area adjacent to the project should not be unduly affected by the proposal.	The majority of land through which the 1.9km realignment traverses in through remnant vegetation in Good to Excellent Condition. The visual amenity therefore will be relatively unchanged.	The visual impact of road upgrade and associated works through DP 8 will vary depending on the nature of the works. However given the relatively flat landscape through the area and the comparatively small area of vegetation to be cleared, the visual amenity will essentially remain unchanged.	The Environmental Management Plan will include control measures to ensure that clearing is restricted to the designated surveyed areas and revegetation of the road reserve enhances ecosystem function and the aesthetic values.	Impacts will be managed through clearing controls and strategic revegetation of the road reserve.

5. ENVIRONMENTAL MANAGEMENT

5.1 Introduction

The upgrade of Great Eastern Highway through DP 8 will result in some impacts on the biophysical and social environment. In most cases the scale of these impacts can be minimised through specific management measures outlined in the Environmental Management Plan that has been prepared for the project. The following preliminary management measures are proposed.

Aline East expects that all impacts associated with the proposal can be avoided, minimised or managed through suitable design, discussion and appropriate management measurers as such as those outlined in the report.

5.2 Biophysical

5.2.1 Vegetation

One of the most critical environmental management issues will be in relation to limiting the clearing of native vegetation to the footprint of the proposed works. It is intended to clear 3.1625ha of remnant vegetation.

Four *Eucalyptus salmonophloia* trees rated as having Very High Significance and three rated as having Medium Significance will be cleared for the road upgrade. Wherever possible, clearing will be minimised to that necessary for construction of the highway.

5.2.2 Environmental Weeds

The most effective measure for the sustainable management of weeds is to use, wherever possible, clean (i.e. weed-seed-free) topsoil, mulch and fill for revegetation and rehabilitation of areas affected by the upgrade. Mixing of topsoil and mulch from areas with heavy weed infestations with soil from uninfected areas should be avoided to control the spread of weeds. Wherever high levels of weed infestation are detected, it is recommended that weed-infected soil be handled separately and disposed of off-site following spraying.

5.2.3 Fauna Corridors

Management controls will be implemented to ensure that corridors of vegetation are maintained and developed to facilitate the movement of fauna between vegetation remnants. Remnant vegetation and trees with High/Very High significance will be protected where possible through sensitive road design. Clearing will be minimised and restricted to that necessary to construct the road to the prescribed standard for safety. Clearing of Salmon Gum (*Eucalyptus salmonophloia*), a species recognised for its value as habitat for parrots, particularly the Carnaby's Black Cockatoo, will be strictly limited.

5.2.4 Wetlands

No wetlands occur within DP 8.

5.2.5 Landscaping and Rehabilitation

A Landscaping and Rehabilitation Plan will be developed. The Plan will focus on the following issues:

- Reuse of topsoil from the project area. This will be subject to careful selection and management due to presence of weeds within DP 8;
- Reuse of brush and chipped/mulched vegetation from the project area;
- Replacement of native vegetation. Local native species will be used in revegetation;
- Species of value to Carnaby's Black Cockatoo for either forage (species with woody nuts in the Proteaceae family) and/or habitat (such as Salmon Gums) will be used where appropriate in revegetation.

5.3 Pollution Management

5.3.1 Noise

The proposed construction of DP 8 will comply with the Main Roads WA Noise Level Objectives and the WAPC Draft Planning Policy for Road and Rail Transport Noise. Following consultation with residents and despite compliance with the WAPC Draft Policy on Road and Rail Transport Noise, a noise bund will be constructed to minimize the impacts resulting from the construction of DP8.

A Construction Noise and Vibration Management plan will detail measures to limit impacts during the construction period such as restricting the use of vibrating rollers and construction working hours. A Complaints Procedure will address what actions will be taken should complaints be lodged about noise.

5.3.2 Surface Water Runoff

An Environmental Management Plan that includes controls to prevent pollution of surface and groundwater is in place. It will include inspections on the road works to locate any areas of erosion caused by surface water runoff and management of chemicals and hazardous materials.

5.3.3 Dust

An Environmental Management Plan that includes controls to prevent dust generation is in place. It includes inspections of active work areas for visible dust and planning of works to minimise dust generated from earthworks, particularly during stripping and handling topsoil. Water sprays will be used as appropriate on exposed surfaces. A Complaints Procedure addresses actions to be taken should complaints be lodged about dust.

5.4 Social Surroundings

5.4.1 Aboriginal Heritage

No archaeological material or ethnographic sites were discovered within DP 8 (Quartermaine, 2006). Heritage Management is included in the Environmental Management Plan and outlines protocols to follow in the event sub-surface cultural remains are encountered during construction. If suspected archaeological artefacts are encountered during construction, work will cease in that area until a suitably qualified and registered specialist can assess the significance of the site in accordance with the *Aboriginal Heritage Act 1972.*

Aline East construction and management employees will be briefed on Aboriginal heritage issues during mandatory inductions and in toolbox meetings.

If an Aboriginal heritage site is located during works and disturbance is unavoidable, written approval to disturb the site will be obtained from the Minister for Indigenous Affairs under Section 18 of the *Aboriginal Heritage Act 1972* (application for 'consent to certain uses'). The site will not be disturbed unless the Minister grants approval.

5.4.2 European Heritage

No European Heritage sites have been identified within DP 8, however if any materials are uncovered during construction, works will cease in that area until a suitably qualified archaeologist has assessed the significance of the materials.

5.4.3 Visual Amenity

The widening and realignment of Great Eastern Highway in DP 8 will not result in significant changes to the landscape and visual amenity as remnant vegetation will be maintained within the realignment and the northern side of the existing road is currently vegetated. Therefore, rehabilitation of the northern road reserve will potentially improve the visual amenity of the GEH.

6. ENVIRONMENTAL MANAGEMENT RECOMMENDATIONS

Table12 provides a list of environmental management recommendations associated with the proposal to upgrade and widen Great Eastern Highway through DP 8. The environmental management recommendations relate to the pre-construction, and construction phases of the project. The “Advice” column relates to the authority, agency or organisation that should be consulted during the formulation of a particular proposed management strategy.

No matters of National Environmental Significance were identified during desktop and field assessments however if any should be identified during construction, the proposal will then be referred to the DEH and DEC.

No groundwater abstraction or dewatering is likely to be necessary for construction of DP 8. However if design changes that may impact surface or groundwater are necessary, the proposal will be referred to the appropriate regulatory authorities for assessment.

TABLE 12
GREAT EASTERN HIGHWAY UPGRADE – SUMMARY OF ENVIRONMENTAL MANAGEMENT RECOMMENDATIONS FOR DP 8

Commitment	Responsibility	Timing	Objective	Action	Advice - Principles
Develop and implement an Environmental Management Plan that contains the following:	Environment and Community Relations Manager	Pre-construction and throughout construction	To ensure that environmental aspects and impacts on flora, fauna, vegetation, surface water, groundwater and Environmentally Sensitive Areas are minimised.	Develop an Environmental Management Plan for the Aline East project.	EPA, Main Roads, DEC
Aboriginal Heritage Management	Environment and Community Relations Manager	Pre-construction and throughout construction	To ensure that no Aboriginal sites are disturbed and that any sites located are protected in accordance with the *Aboriginal Heritage Act 1971.*	- Notify DIA of any suspected sites located during construction. - Site Inductions and Toolbox presentations to make personnel aware of heritage issues. - Engage suitably qualified consultant to assess suspected sites. - Submit 'Consent to Certain Uses' Application under Section 18 of the *Aboriginal Heritage Act 1972* if disturbance is unavoidable.	DEC on advice from the DIA
Borrow and Spoil Management	- Environmental and Community Relations Manager - Alliance Manager - Construction Manager	Prior to clearing for construction	To ensure that: • optimal use is made of resources; • approvals are given prior to any disturbance; and • that borrow pits are adequately rehabilitated.	Identify environmental values of resource pits and ensure works do not impact significant values and that rehabilitation meets completion criteria.	Main Roads, DoIR
Dust and Air Quality Management	- Environmental and Community Relations Manager - Alliance Manager - Construction	Prior to clearing for construction	To ensure that dust or emissions do not impact adjacent land owners or the environment.	Implement dust management procedures in EMP and ITPs. Record and respond to public complaints and non-compliances.	Shire of Merredin

Commitment	Responsibility	Timing	Objective	Action	Advice - Principles
	Manager				
Erosion Management	- Environmental and Community Relations Manager - Alliance Manager - Construction Manager	Prior to clearing for construction	To ensure that landforms and water are managed to minimise erosion.	Design culverts, floodways and raised areas to minimise erosion. Audit to ensure no major loss of sediments.	
European Heritage Management	- Environmental and Community Relations Manager - Alliance Manager - Construction Manager	During design phase Prior to and during construction	To ensure that all historical values are recognized and protected.	- Heritage Places avoided during design.	Shire of Merredin
Fauna Management	- Environmental and Community Relations Manager - Alliance Manager - Construction Manager	During design phase	- To protect all species of native fauna. - To ensure that feral animal populations do not increase as a consequence of works in these areas.	- Identify fauna and their habitat in design packages (particularly Threatened Fauna). Protocols included in EMP. - No pets or firearms allowed on site. - If any Nationally Threatened Species or communities are likely to be impacted, the proposal will be concurrently referred to the DEC and DEH.	DEC
Fire Management	Aline East Safety Manager	During construction and rehabilitation	To minimise the risk of fire.	Identify potential sources of fire and controls.	DEC FESA
Flora and Vegetation Management Flora and Vegetation Management	- Environmental and Community Relations Manager - Alliance Manager - Construction Manager	During design phase	Minimise impact of project on vegetation. Ensure that no DRF, TEC or ESA's are impacted by the project.	Identify all flora and vegetation of significance, including significant trees and incorporate this information into the design plans.	DEC, DAF
		Prior to and during clearing		Conduct clearing according to Process Controls.	Rehabilitation consultants and environmental

Commitment	Responsibility	Timing	Objective	Action	Advice - Principles
					consultants.
		During rehabilitation	To ensure that weed populations do not increase as a consequence of works in these areas and that weed species are not introduced into the area.	- Rehabilitate to enhance ecosystem function and improve visual amenity. - Vehicles and machinery must be clean (of soils) and weed free. - Rehabilitation to be carried out as soon as possible following completion of works.	DEC
Hydrocarbon and Hazardous Goods Management	- Environmental and Community Relations Manager - Alliance Manager - Construction Manager	Throughout project	To ensure that hydrocarbons and hazardous goods are transported, stored and cleaned up according to best practice and standards.	- Identify all HC's and Hazardous goods used in project. - Transport, handle and store in accordance with Australian Standards. - Audit to ensure they are transported, stored & cleaned up appropriately.	DoIR
Land Access Management	- Environmental and Community Relations Manager - Alliance Manager - Construction Manager	During design planning and construction	- To ensure that design packages are constructed within road reserves. - To ensure that access is regulated according to land owners' requirements.	- Secure land tenure for road reserves. - Regulate access to properties.	- Main Roads Land Tenure - DPI – LAMS DAF
Landscaping and Rehabilitation	- Environmental and Community Relations Manager	During design planning and construction	To ensure that Rehabilitation enhances ecosystem function and improves visual amenity.	- prepare a Landscape and Rehabilitation Plan and undertake rehabilitation in accordance with the plan - Identify areas to rehabilitate that enhance existing vegetation remnants. - Re-use topsoil from the project area in revegetation, with careful	DEC Shire of Merredin

Commitment	Responsibility	Timing	Objective	Action	Advice - Principles
				management of topsoil to minimise spread of weeds. - Use of brush and chipped/mulched vegetation in rehabilitation. - Use of local native species in revegetation. - Where possible, plant species of habitat or forage value to Carnaby's Black Cockatoo in revegetation.	
Noise and Vibration Management	- Environmental and Community Relations Manager - Alliance Manager - Construction Manager	During construction	- To ensure that construction does not cause damage to property or disturbance. - Ensure that the community is aware of Complaints Procedure.	- Regulate use of vibrating rollers (time and proximity to residences). - Manage Complaints in accordance with Procedure. - Prepare a Construction Noise and Vibration Management Plan.	Shire of Merredin
Pest Management	- Environment and Community Relations Manager - Safety Manager	Throughout project	To ensure that feral animal and weed populations do not increase as a consequence of works in these areas.	-No pets allowed on site. - Waste managed to prevent foraging by feral animals.	DEC DAF
Public Consultation Management	Environment and Community Relations Manager	Throughout project	To ensure that all affected parties are consulted regarding the alignment and works.	Stakeholder consultation plan is implemented.	
Surface and Groundwater Management	- Environment and Community Relations Manager - Alliance Manager Construction Manager	Throughout the project	To ensure that impacts on ground and surface water are minimised.	Implement Surface and Groundwater Management Plans. - If dewatering or abstraction is required for road construction an application for a 5C licence to take surface and/or groundwater will be submitted to the DoE.	DAF DEC
Waste Management	- Environment and Community Relations Manager	Throughout the project	To prevent pollution and minimise the use of non-renewable resources.	- Implement a Waste Management Plan that includes waste minimization, reuse, recycling and	

Commitment	Responsibility	Timing	Objective	Action	Advice - Principles
	- Alliance Manager Construction Manager			disposal.	

DAF = Department of Agriculture and Food
DEC = Department of Environment and Conservation
DIA = Department of Indigenous Affairs
DoIR = Department of Industry and Resources
DPI - LAMS = Department of Planning and Infrastructure, Land Asset Management Services
EPA = Environmental Protection Authority
FESA = Fire and Emergency Services Authority of Western Australia

7. CONSULTATION

7.1 Public Consultation

A Community and Stakeholder Relations Plan (CSRP) has been developed for Aline East that sets out the strategic framework for managing communications for the project including all community and stakeholder liaison and media management.

This plan has been developed to control the development and distribution of messages to ensure that a clear and consistent image, reflecting the overall philosophy and direction of Aline East is presented to all project stakeholders and audiences.

This strategy will direct the project team in the way it communicates with its audiences to provide a constant communication flow that delivers accurate information in a timely and transparent manner.

The plan also:

- States the communication objectives in relation to the Project;
- Outlines the evaluation procedures by which these objectives will be measured;
- Has been developed to fit within the Project's Integrated Management System (IMS);
- Provides a communications program that addresses the key areas of responsibility listed above and outlines strategies to address them.

Communication is undertaken in a continuously changing environment, therefore, it is imperative that this strategy be evaluated, refined and where necessary revised on an ongoing basis to ensure that it continues to reflect the project's needs and Main Roads' and the State and Federal Government's strategic requirements.

Aline East aims to maintain a high level of consultation with the local community to maximise opportunities for community input into the project.

Aline East has visited three Shires – Merredin, Kellerberrin and Westonia. The aim was to establish contact, provide an overview of the project and establish contacts for further liaison. Merredin and Kellerberrin Shire councils have established working groups with a nominated chairperson. The purpose of these working groups is to provide ALine East with a point of contact and forum for discussion. Meetings with these groups have ensured issues have been identified and evaluated during the early stages of the project.

Aline East attended the Merredin Agricultural Show on the 8th October 2005 and set up a manned display to provide an overview of the project and to field community questions. Records of issues raised were recorded and entered on the Community Issues Register established as a repository for feedback from the community. This register ensures that issues are captured and considered during all phases of the project. Comments are considered during the design phase and incorporated into preliminary designs were appropriate.

ALline East has liaised with the Merredin Land Conservation District Committee (LCDC) about the potential environmental impacts of the project and the management strategies that will be adopted to minimise impacts. The Environmental and Community Relations Manager will meet with the Merredin LCDC in October 2006 to discuss the project.

7.2 Government Agency Consultation

Comments on the key environmental and heritage issues were sought from the following State Government Authorities:

- Department of Agriculture and Food;
- Department of Conservation & Land Management (CALM) (now DEC);
- Department of Environment (Northam) (now DEC);
- Department of Indigenous Affairs;
- Environmental Protection Authority;
- Main Roads; and the
- Shire of Merredin.

A meeting was held with the then Department of Environmental (DoE) (now Department of Environment and Conservation (DEC) to discuss whether the project should be referred the EPA for assessment. The DEC Northam stated that further liaison for approvals would only be required should Aline East wish to disturb any Environmentally Sensitive areas. DEC Northam also requested to be notified prior to commencement of clearing.

The EPA Services Unit provided advice that only proposals likely to have significant environmental impacts would need to be referred to the EPA under Section 38 of the *Environmental Protection Act*.

CALM, (now DEC) provided information on Threatened Ecological Communities in the area. The Environment and Community Relations Manager for ALine East has discussed the proposed realignment with David Jolliffee, District Nature Conservation Officer, DEC-Merredin Wheatbelt Region. Annotated aerial photographs showing the extent of clearing were provided. DEC Merredin provided advice that the department had no issue or objection to the proposed realignment and associated clearing as it was being assessed under the statutory conditions of Main Roads Purpose Clearing Permit.

The Department of Indigenous Affairs did not provide any comment on the proposal.

ALine East has undertaken extensive liaison with the Shire of Merredin, the Department of Agriculture and Food and Main Roads regarding the use of ground water (and town run off dams) in road construction. This initiative is seen as an opportunity by all parties to utilize a currently unrealized resource (saline ground water and town surface water run off) whilst at the same time addressing rising groundwater and salinity within the town of Merredin and minimizing the use of potable water from the Kalgoorlie pipeline.

8. APPROVALS

8.1 Commonwealth Government

No Threatened Ecological Communities or flora listed under the Commonwealth's *Environmental Protection Biodiversity Conservation Act (EPBC) 1999* has been identified within the project area.

Four species of bird listed under the EPBC Act are expected to occur in the study area (Carnaby's Black Cockatoo, Peregrine Falcon, Rainbow Bee-eater and Fork-tailed Swift), but would only trigger referral if the impacts on the species were considered to be significant. The guidelines on significance which relate to the EPBC Act mention that significance means loss of a large area of breeding or feeding grounds or a direct loss of a considerable percentage of the population. The Peregrine Falcon, Rainbow Bee-eater and Fork-tailed Swift are migratory species. Given the minimal and linear nature of the clearing, the project is unlikely to have a significant impact on any of these species.

The Carnaby's Black-Cockatoo may utilise the small remnants of vegetation for feeding. However, these remnants are generally degraded and there are other areas of higher quality remnant vegetation in the general area of DP 8 that the Black-Cockatoos may utilise for feeding. The trees rated as having High and Very High significance within DP 8 did not support hollows of adequate size to support Carnaby's Black Cockatoos. The project is not expected to have a significant impact on this species.

No other issues which would trigger referral under the EPBC Act are present in or adjoining the project area.

8.2 Western Australian Government

This project will result in the clearing of 4.345 ha, of which 3.1625 ha is vegetated. The project will have no impact on significant flora or vegetation. Four trees rated as having Very High Significance will be cleared.

The project adheres to the ten Clearing Principles detailed in Main Roads Clearing Permit (Purpose Permit) issued to Main Roads by the Department of Environment on the 1st February 2006 under the *Environmental Protection (Clearing of Native Vegetation) Regulations* 2004 and therefore does not require referral to the Environmental Protection Authority for assessment. A completed checklist detailing compliance with the Ten Clearing Principles in Main Roads Purpose Permit CPS 818/2 is provided as Table 13.

TABLE 13
APPLICATION OF TEN CLEARING PRINCIPLES TO
DESIGN PACKAGE 8 (SLK 264.3 - 267.0), GREAT EASTERN HIGHWAY

ITEM NO.	Ten Clearing Principles Variance Checklist	Y/N	Comment	Report Section
1	Does the area to be cleared comprise a high level of biological diversity?	N	The area to be cleared does not have a high level of biological diversity. The project will result in the clearing of 3.1625 ha of remnant vegetation in good condition. The project will have no impact on significant flora or vegetation, does not contain specific features or special habitats for fauna nor any Threatened Ecological Communities. A total of 89 plant species (79 native and 10 introduced) were recorded from the project area. The vegetation to be cleared is represented in the A Class reserve 23580, located approximately 1.3km to the west of the western boundary of DP 8.	3.2.7 3.2.8 3.4.4
2	Does the area to be cleared comprise the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia?	N	The project will result in the loss of 3.1625 ha of remnant vegetation. The area to be cleared does not represent a significant habitat for Western Australian fauna. A site assessment determined that no hollows suitable for Carnaby's Black Cockatoo will be impacted by the clearing. Species of value to Carnaby's Cockatoo (forage &/or habitat) will be used in revegetation where appropriate. Similar habitat is present in the A Class reserve 23580, located approximately 1.3km to the west of the western boundary of DP8	3.4.4
3	Does the area to be cleared include, or is necessary for the continued existence of, rare flora?	N	A search of the DEC databases identified fifty flora species of conservation significance occur within the general vicinity of DP8. No species of conservation significance were recorded during the site assessment by qualified botanists.	3.2.2 3.2.8

4	Does the area to be cleared comprise the whole or a part of, or is necessary for the maintenance of a threatened ecological community (TEC)?	N	A search of the CALM TEC database found no known occurrences of TECs within DP8. No inferred TECs occur within the project area.	3.2.8
5	Is the area to be cleared significant as a remnant of native vegetation in an area that has been extensively cleared?	N	The vegetation communities within DP8 resembles Beard Vegetation Association 36 and Vegetation Association 1055, of which there is 49.7% and 10.7% respectively of the pre European extent remaining (Beeston et al, 2002). The vegetation to be cleared resembles Vegetation Association 36. None of the vegetation resembling Vegetation Association 1055 will be cleared. The State Government is committed to the National Objectives Targets for Biodiversity Conservation which includes a target that prevents clearing ecological communities with less than 30% of the extent at pre European settlement remaining (EPA, 2000). Given that an estimated 49.7% of Vegetation Association 36 remains, the clearing is not considered to be a significant conservation threat. The extent of vegetation remaining in the Avon Wheatbelt Bioregion is 16.0% (Shepherd et al, 2001). The project is located within the Agricultural Area as defined by EPA Position Statement No 2 (EPA, 2000). The EPA position is that it does not support clearing of native vegetation in the agricultural area for agricultural purposes. While the vegetation is to be cleared is located within the agricultural region, the purpose of the clearing is for the upgrading of Great Eastern Highway. Disturbed areas will be revegetated as part of the project	3.2.8
6	Is the area to be cleared growing in, or in association with, an environment	N	No wetlands/watercourses occur within DP8. None of the vegetation is considered to be wetland	3.1.3

	associated with a watercourse or wetland?		dependent vegetation	
7	Is the clearing of the vegetation likely to cause appreciable land degradation?	N	The Environmental Management Plan will address the issues of drainage, erosion and contaminant management. There is low risk associated with land degradation issues of salinity, wind & water erosion.	Table 11
8	Is the clearing of the vegetation likely to have an impact on the environmental values of any adjacent or nearby conservation area?	N	No conservation reserves or other significant bushland is located within or immediately adjoining the site. An A class reserve vested in the Shire of Merredin for the purpose of Recreation (Reserve No 23580) is located 1.3km to the west of the western boundary of DP8. Given the distance from the A class reserve, it is unlikely that the proposed clearing will impact on the reserve	Figs 2a-d
9	Is the clearing of the vegetation likely to cause deterioration in the quality of surface or underground water?	N	There is low potential for the impact on surface water quality due to the nature of the road making process and products utilized for construction. The Project Environmental Management Plan will address the issues of drainage, erosion and contamination management. Drainage design, contaminated water control and rehabilitation will ensure no direct or indirect impacts on the catchment.	Table 11
10	Is the clearing of the vegetation likely to cause, or exacerbate, the incidence of flooding?	N	The area is on a slight rise and is not currently subject to flooding. There is no surface water /wetlands within or adjacent to the project area. The project incorporates drainage design. The clearing of 3.1625ha of vegetation will not cause or exacerbate flooding. The Project Environmental Management Plan will address the issue of drainage.	3.1.3, Table 11

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FIGURES

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DATUM: MGA

BRC-2005-002/MGMT/26_182-F01.dgn

TRAYNING

NUNGARIN

WYALKATCHEM

Road

Kellerberrin

Westonia

Walgoolan

HIGHWAY

280

290

300

Carrabin

WESTONIA

270

DP8

Merredin

260

DP10

MERREDIN

Nangeenan

250

EASTERN

DP2

DP3

YILGARN

Hines Hill

240

DP1

DP6

Bencubbin

KELLERBERRIN

230

220

TAMMIN

Doodlakine

Bungulla

190

210

Kellerberrin

200

GREAT

Bruce Rock

170

180

Tammin

Road

Goldfields

Road

Yoting

Road

Kellerberrin

Road

Merredin

Merredin

Road

Doodlakine

Road

Bruce Rock

Road

Narembeen

Road

BRUCE ROCK

QUAIRADING

NAREMBEEN

kilometres

0 5 10 15 20

SCALE 1 : 350 000

LEGEND

- Highway
- Major Road
- Minor Road
- Shire Boundary
- Watercourse
- 180 Chainage
- DP6 Design Package

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ENVIRONMENTAL IMPACT ASSESSMENT
DESIGN PACKAGE 8
GREAT EASTERN HIGHWAY

REGIONAL LOCATION

FIGURE 1

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LEGEND

- Cadastral Boundary
- Proposed Road Edge
- Proposed Earthworks
- 240400 Chainage

See Figure 1 for Location

Vegetation Legend

- (L) Tree - Low Significance
- (M) Tree - Medium Significance
- (H) Tree - High Significance
- (VH) Tree - Very High Significance
- Remnant or Planted Vegetation
- (L) Tree/Vegetation to be Removed
- EoEl Vegetation Type *(See Figure 2d)*
- G-D Vegetation Condition *(See Figure 2d)*

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BASE & AERIAL PHOTO SOURCE: ALine East, November 2005.

ENVIRONMENTAL IMPACT ASSESSMENT
DESIGN PACKAGE 8
GREAT EASTERN HIGHWAY

ENVIRONMENTAL CONSTRAINTS DESIGN PACKAGE 8

FIGURE 2a

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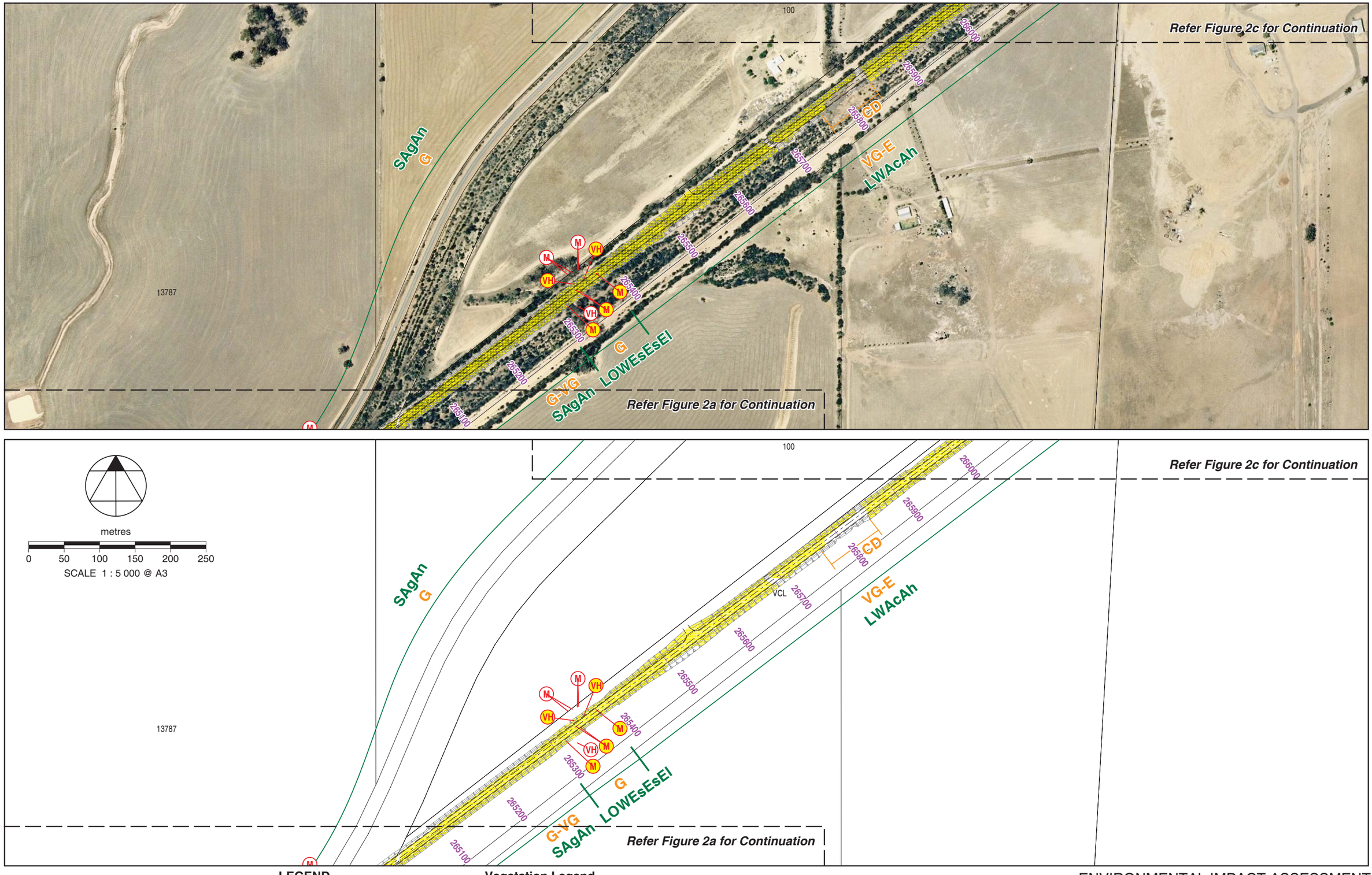

LEGEND

- Cadastral Boundary
- Proposed Road Edge
- Proposed Earthworks
- 240400 Chainage

See Figure 1 for Location

Vegetation Legend

- L Tree - Low Significance
- M Tree - Medium Significance
- H Tree - High Significance
- VH Tree - Very High Significance
- Remnant or Planted Vegetation
- L Tree/Vegetation to be Removed
- EoEl Vegetation Type *(See Figure 2d)*
- G-D Vegetation Condition *(See Figure 2d)*

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ENVIRONMENTAL IMPACT ASSESSMENT
DESIGN PACKAGE 8
GREAT EASTERN HIGHWAY

ENVIRONMENTAL CONSTRAINTS DESIGN PACKAGE 8

FIGURE 2b

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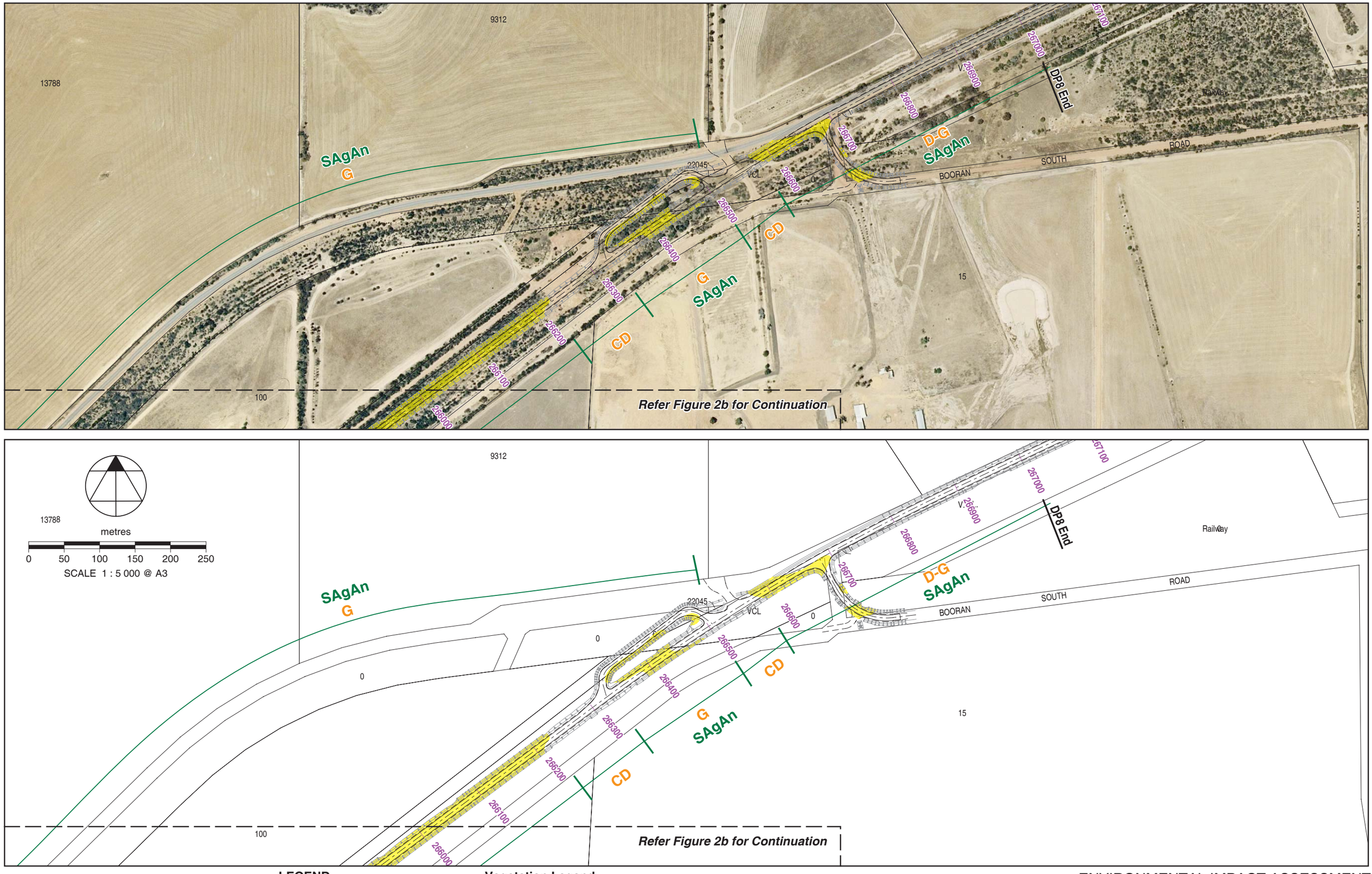

LEGEND

- Cadastral Boundary
- Proposed Road Edge
- Proposed Earthworks
- 240400 Chainage

See Figure 1 for Location

Vegetation Legend

- (L) Tree - Low Significance
- (M) Tree - Medium Significance
- (H) Tree - High Significance
- (VH) Tree - Very High Significance
- Remnant or Planted Vegetation
- (L) Tree/Vegetation to be Removed
- EoEI Vegetation Type *(See Figure 2d)*
- G-D Vegetation Condition *(See Figure 2d)*

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ENVIRONMENTAL IMPACT ASSESSMENT
DESIGN PACKAGE 8
GREAT EASTERN HIGHWAY

ENVIRONMENTAL CONSTRAINTS DESIGN PACKAGE 8

FIGURE 2c

VEGETATION TYPE LEGEND

LOWEsEsEl Low Open Woodland dominated by *Eucalyptus salmonophloia*, *Eucalyptus salubris* and *Eucalyptus loxophleba* subsp. *lissophloia* with occasional *Casuarina obesa* over a Tall Shrubland to 2m dominated by *Acacia acuminata*, *Acacia hemiteles* and *Acacia assimilis* subsp. *assimilis* over a Herbland dominated by *Atriplex bunburyana* over a Grassland dominated by *Avena fatua*.

SAgAn Shrubland to 2m dominated by Acacia ?*gibbosa* and *Acacia neurophylla* subsp. *erugata* with occasional *Eucalyptus erythronema* var. *erythronema* over a Low Open Shrubland to 1m dominated by *Melaleuca cordata* and *Grevillea paradoxa* with occasional *Grevillea didymobotrya* subsp. *didymobotrya* over an Open Grassland of *Avena fatua* and *Eragrostis curvula* over an Open Herbland dominated by *Waitzia acuminate*.

LWAcAh Tall closed scrub to Tall shrubland of *Allocasuarina campestris* and *Allocasuarina huegeliana* with occasional *Santalum acuminatum* over Scattered tall shrubs *Acacia* spp. including *Acacia neurophylla* subsp. *erugata* over Scattered Shrubs of *Astroloma serratifolium*, *Phebalium tuberculatum* and *Isopogon scabriusculus*. over Scattered *Lepidosperma brunonianum* and *Drosera* sp. (rosettes).

VEGETATION CONDITION LEGEND

The vegetation condition was described using Bush Forever's condition scale rating (Government of Western Australia, 2000) which includes six main categories ranging from Completely Degraded to Pristine. The condition categories relevant to the study area are described below:

E **Excellent** - Some relatively slight signs of damage caused by the activities of European, for example, disturbance caused by repeated fires and the presence of non-aggressive weeds.

VG **Very Good** - Vegetation structure altered, obvious signs of disturbance. For example, disturbance caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing

G **Good** - Vegetation structure significantly altered by very obvious signs of multiple disturbances. Vegetation retains basic structure or ability to regenerate it, for example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

D **Degraded** - Basic vegetation structure severely impacted by disturbance. There is scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

CD **Completely Degraded** - The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with flora composing weed or crop species with isolated native trees or shrubs.

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ENVIRONMENTAL IMPACT ASSESSMENT
DESIGN PACKAGE 8 - GREAT EASTERN HIGHWAY

VEGETATION TYPE AND CONDITION LEGEND

FIGURE 2d

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FILL BATTER TABLE

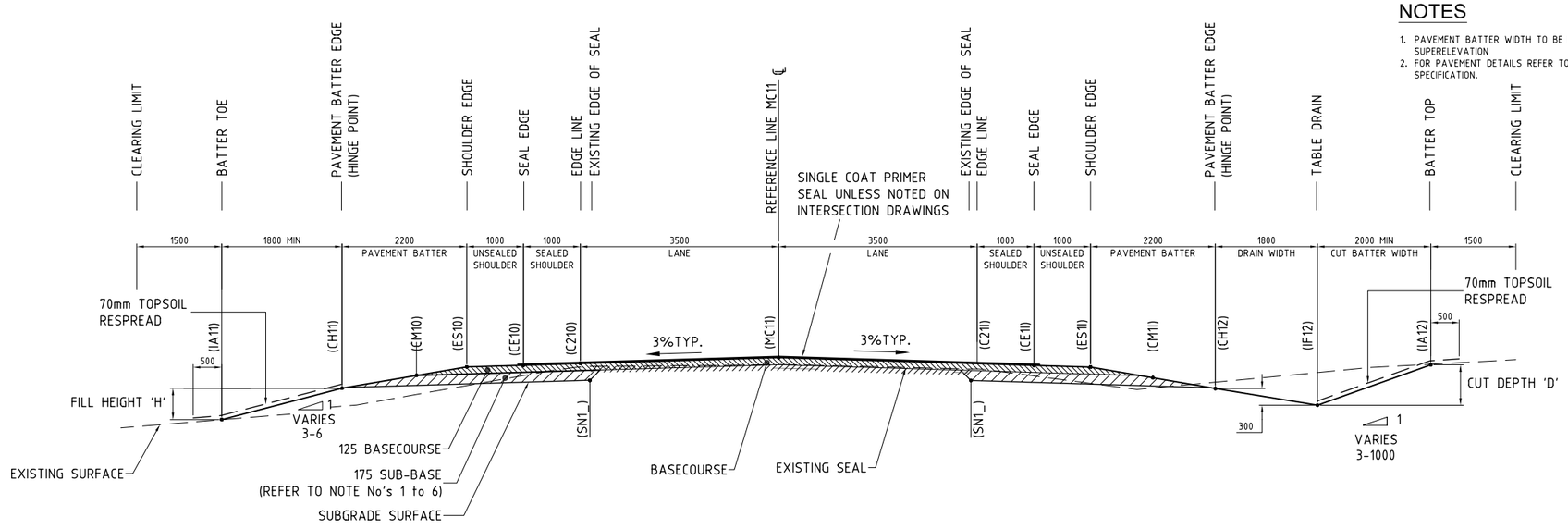
FILL HEIGHT 'H'	FILL BATTER SLOPE 1 IN 'n'	FILL BATTER WIDTH
0 - 300	1IN 6	TABLEDRAIN REQUIRED
300 - 600	1 IN 6 TO 1 IN 3	CONSTANT 1800
600+	1IN 3	VARIES 1800+

CUT BATTER TABLE

CUT DEPTH 'D'	CUT BATTER SLOPE 1 IN 'n'	CUT BATTER WIDTH
0 - 667	LEVEL TO 1 IN 3	CONSTANT 2000
667+	1 IN 3	VARIES 2000+

NOTES

1. PAVEMENT BATTER WIDTH TO BE MAINTAINED ON SUPERELEVATION.
2. FOR PAVEMENT DETAILS REFER TO TECHNICAL SPECIFICATION.



TYPICAL CROSS SECTION - WIDENING BOTH SIDES AND OVERLAY

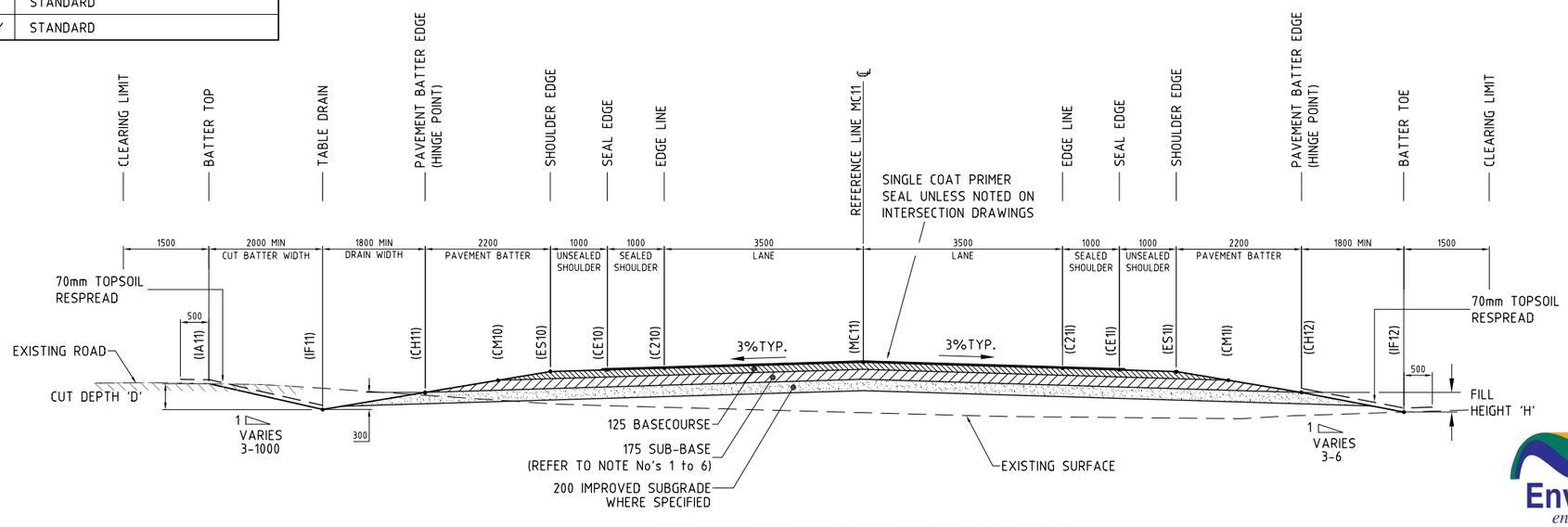
1:50

PAVEMENT TABLE

CHAINAGE	BASECOURSE DEPTH	SUBBASE DEPTH	TREATMENT	PAVEMENT
239160 - 239330	125mm	175mm	WIDEN AND OVERLAY	STANDARD
239330 - 239430	200mm	300mm	WIDEN AND OVERLAY	CEMENT STABILISED BASECOURSE
239430 - 240590	125mm	175mm	WIDEN AND OVERLAY	STANDARD
240590 - 240700	200mm	300mm	WIDEN AND OVERLAY	CEMENT STABILISED BASECOURSE
240700 - 241600	125mm	175mm	WIDEN AND OVERLAY	STANDARD
241600 - 242390	125mm	175mm	REALIGNMENT	STANDARD
242390 - 242540	200mm	400mm	REALIGNMENT	CEMENT STABILISED BASECOURSE
242540 - 243450	125mm	175mm	REALIGNMENT	STANDARD WITH IMPROVED SUBGRADE
243450 - 243640	125mm	175mm	REALIGNMENT	STANDARD
243640 - 245200	125mm	175mm	WIDEN AND OVERLAY	STANDARD

OVERLAY TREATMENT FOR SUB BASE NOTE

1. IMPORTED GRAVEL SUB BASE MATERIAL SHALL BE ADDED TO THE EXISTING PAVEMENT AS REQUIRED UP TO THE SUB BASE LEVEL (IE DESIGN LEVEL MINUS 125MM).
2. WHERE THE EXISTING PAVEMENT IS ABOVE THE SUB BASE LEVEL IT SHALL MILLED OUT TO THIS LEVEL (WITH MINIMUM DISTURBANCE TO THE UNDERLYING PAVEMENT) AND REMOVED.
3. WHERE THE NEW SUB BASE LAYER OVER THE EXISTING PAVEMENT IS LESS THAN 100MM IT SHALL BE MIXED WITH THE UNDERLYING LAYER TO A MINIMUM DEPTH OF 100MM AND COMPACTED.
4. THE SUB BASE LAYER SHALL BE A MIXTURE OF THE OLD PAVEMENT MATERIAL, THE EXISTING SEAL AND IMPORTED SUB BASE MATERIAL COMPACTED AND TRIMMED TO THE SPECIFIED SUB BASE LEVELS AND DENSITY BEFORE THE PLACEMENT OF THE BASECOURSE LAYER.
5. WHEREVER POSSIBLE DISTURBANCE TO THE EXISTING PAVEMENT IS TO BE KEPT TO A MINIMUM.
6. NO DENSITY TESTING IS REQUIRED ON THE PORTIONS OF THE SECTION WHERE THE EXISTING PAVEMENT HAS NOT BEEN DISTURBED.



TYPICAL CROSS SECTION - REALIGNMENT

1:50

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ENVIRONMENTAL IMPACT ASSESSMENT
DESIGN PACKAGE 8
GREAT EASTERN HIGHWAY
TYPICAL CROSS SECTION
FIGURE 3

SOURCE: ALine East, Dwg. No. GEH-DP01-CIV-400, Rev. C1, 16-02-06.

BRC-2005-002/MGMT/26_182-F03.dgn DATUM: MGA DRAWN BY: EDS 11-08-06 CHECKED BY: JA 11-08-06

PLATES

Plate 1 Vegetation type SAgAn (Good Condition) near 266.4 (new SLK) in eastern end of realignment area.

Plate 2 Two High Significance trees, several Medium Significance trees and vegetation proposed to be cleared (on LHS of photograph) in Good Condition LOWEsEsEl at approximately SLK 265.36 on the new alignment. (looking west)

Plate 3 Looking west along realignment at ca SLK 265.1 (new alignment) proposed clearing of vegetation type SAgAn (Good – Very Good Condition) on left hand side of track.

Plate 4 Vegetation type SAgAn (in Good – Very Good Condition) proposed to be cleared at ca SLK 265.3 (new alignment) looking south towards water pipeline

APPENDICES

APPENDIX 1
CLASSIFICATION SYSTEM FOR SIGNIFICANT TREES ON ALINE EAST PROJECT

APPENDIX 1 CLASSIFICATION SYSTEM FOR SIGNIFICANT TREES ON ALINE EAST PROJECT

TREE SPECIES	MEASURED CIRCUMFERENCE AT BREAST HEIGHT	CLASSIFICATION	JUSTIFICATION
Eucalyptus salmonophloia	0-150 cm	Medium	
	150-200 cm	Medium	
	200-250 cm	High (H)	Aesthetics and age
	> 250 cm	Very High (VH)	Aesthetics, age & development of hollows
Eucalyptus salubris	150 – 200	Very High	Aesthetics & age, hollows for smaller parrots
	100-150	High	Aesthetics & age
Species not endemic to region	200+	Very High	Amenity & social values
	150-200	High	
	<150	Low	Replacement time relatively low
Rehabilitated areas	CBH <100 mm	Medium	Age of rehabilitation and understorey is generally poor
	CBH <50 cm	Low	Replacement time relatively low

Note: National Trust of South Australia's notion of "significant tree" = CBH (circumference at breast height) > or =200 cm

GUIDING PRINCIPLES

If a choice has to be made between clearing several Very High or High Significance Trees or rehabilitated land then the significant trees should be retained, particularly if these trees are local natives.

Remnant vegetation, particularly with intact understorey is ranked higher than:

- rehabilitated land; and
- isolated High Significance trees, particularly if they are already very close to the GEH with no understorey.

APPENDIX 2
FLORA SPECIES LIST FOR DP 8

APPENDIX 2 - FLORA SPECIES LIST FOR DP 8
***-denotes introduced (weed) species**

Family	Genus/Species	Opp.	Q1	Q2	Q3
MONOCOTYLEDONS					
CYPERACEAE	*Lepidosperma brunonianum*	X			X
	Schoenus hexandrus	X	X		
ECDEIOCOLEACEAE	*Ecdeiocolea monostachya*	X			
POACEAE	**Avena fatua*	X			
	**Bromus diandrus*	X			
	**Briza minor*	X			
	**Cynodon dactylon*	X			
	**Ehrharta calycina*	X			
	**Eragrostis curvula*	X			
	Neurachne alopecuroidea	X		X	
	Poaceae sp.*(tufted grass)*			X	X
RESTIONACEAE	*Chordifex* aff. *sphacelatus*	X			
DICOTYLEDONS					
ANTHERICACEAE	*Borya constricta*	X		X	
	Thysanotus patersonii	X			
ASTERACEAE	*Hyalosperma cotula*	X			
	**Hypochaeris glabra*	X			
	**Sonchus oleraceous*	X			
	**Ursinia anthemoides*	X			
	Waitzia acuminata	X			
BRASSICACEAE	**Rhaphanus rhaphanistrum*	X			
CAESALPINIACEAE	*Senna* sp.	X			
CASUARINACEAE	*Allocasuarina campestris*	X	X	X	X
	Allocasuarina huegeliana	X	X	X	X
	Casuarina obesa	X			
CHENOPODIACEAE	*Atriplex bunburyana*				
	Halosarcia indica subsp. *bidens*				
	Halosarcia sp.				
	Salsola tragus	X			
DASYPOGONACEAE	*Lomandra effusa*	X			
	Lomandra mucronata				X
DILLENIACEAE	*Hibbertia* sp.	X	X		
DROSERACEAE	*Drosera* sp. *(climbing)*				X
	Drosera sp. *(rosettes)*		X	X	
EPACRIDACEAE	*Astroloma serratifolium*		X	X	
	Leucopogon sp.		X	X	
EUPHORBIACEAE	*Beyeria brevifolia* var. *robustior*	X			
GOODENIACEAE	*Goodenia* sp.	X			
HALORAGACEAE	*Glischrocaryon aureum*	X			
LAURACEAE	*Cassytha glabella*			X	X
MIMOSACEAE	*Acacia acuminata*	X			
	Acacia assimilis subsp. *assimilis*				

APPENDIX 2 - FLORA SPECIES LIST FOR DP 8
***-denotes introduced (weed) species**

Family	Genus/Species	Opp.	Q1	Q2	Q3
	Acacia colletoides	X			
	Acacia gibbosa	X			
	Acacia intricata	X			
	Acacia hemiteles				
	Acacia longispinea		X		
	Acacia merrallii				
	Acacia neurophylla subsp*. erugata*	X			
	Acacia yorkrakinensis subsp. *acrita*	X			
MYOPORACEAE	*Eremophila* sp.	X			
MYRTACEAE	*Baeckea crispiflora var. tenuior*	X			
	Baeckea muricata	X			
	Calothamnus quadrifidus	X			
	Eucalyptus ?campaspe				
	Eucalyptus erythronema var erythonema	X			
	Eucalyptus loxophleba subsp. *lissophloia*	X			
	Eucalyptus orthrostemon (ms)				
	Eucalyptus salmonophloia	X			
	Melaleuca cordata	X	X		X
	Melaleuca calyptroides	X			
	Micromyrtus obovata	X			X
	Thryptomene kochii	X			X
	Verticordia chrysantha	X			
	Verticordia picta	X			
PAPILIONACEAE	*Gastrolobium floribundum*	X		X	
PHORMIACEAE	*Dianella revoluta*	X			X
PITTOSPORACEAE	*Billardiera coriacea*	X			
PLUMBAGINACEAE	**Limonium sinuatum*				
POLYGALACEAE	*Comesperma volubile*	X		X	
PROTEACEAE	*Grevillea didymobotrya ssp. 2*	X			
	Grevillea eriostachya				
	Grevillea hakeoides	X			X
	Grevillea hookeriana subsp. *apicifolia*	X			
	Grevillea juncifolia subsp. *juncifolia*	X			
	Grevillea orange			X	
	Grevillea paradoxa	X			
	Hakea cygna	X			
	Hakea erecta	X			
	Hakea francisciana	X			
	Isopogon gardneri		x		X
	Isopogon scabriusculus	X		X	X
RHAMNACEAE	*Cryptandra ?micrantha*	X			
RUTACEAE	*Beyeria brevifolia* var. *robustior*	X			
	Drummondita hassellii				X

APPENDIX 2 - FLORA SPECIES LIST FOR DP 8
***-denotes introduced (weed) species**

Family	Genus/Species	Opp.	Q1	Q2	Q3
	Phebalium tuberculosum	X	X		X
SANTALACEAE	*Leptomeria preissiana*	X			
	Santalum acuminatum	X			X
SAPINDACEAE	*Dodonaea bursariifolia*	X			
THYMELAEACEAE	*Pimelea* sp.	X			

Opp. = opportunistic collection within DP 8

Quadrat 1

Tall closed scrub of *Allocasuarina campestris* and *Allocasuarina huegeliana* over Scattered tall shrubs *Acacia* spp. over Scattered Shrubs of *Astroloma* and *Leucopogon* sp. over Scattered *Lepidosperma brunonianum* and *Drosera* sp. (rosettes).

Condition: Excellent

DOMINANT SPECIES	% COVER	HEIGHT (m)
Allocasuarina campestris	5	2.5
Allocasuarina huegeliana	70	2 – 2.5
Acacia neurophylla subsp. *erugata*	5	3-4
Acacia longispinea	5	2.5
Grevillea hakeioides	2	1.5
Astroloma serratifolium	<1	1
Leucopogon sp.	1	1
Schoenus hexandrus	<<1	0.20
Lepidosperma brunonianum	<<1	0.45
Drosera sp.	<<1	0.05

Quadrat 2

Tall shrubland of *Allocasuarina campestris*, *Allocasuarina huegeliana* over an Open Shrubland of *Astroloma serratifolium, Isopogon scabriusculus* and *Leuocopon* sp. Over Open grassland.

Condition: Good

DOMINANT SPECIES	% COVER	HEIGHT (m)
Allocasuarina campestris	10-30	3 - 3.5
Allocasuarina huegeliana	10	2 – 2.5
Astroloma serratifolium	10	0.6
Isopogon scabriusculus	1	1
Leucopogon sp.	1	1
Grevillea sp.	<1	0.4
Poaceae sp. (tufted grass)	10- 30	0.15
Borya sphaerocephala	1	0.05
Neurachne alopecuroidea	<1	0.15
Drosera sp.	1	0.02

Quadrat 3

Tall shrubland of *Allocasuarina campestris*, *Allocasuarina huegeliana*, *Santalum acuminatum* over Open Heath of *Acacia, Phebalium tuberculatum, Isopogon scabriusculus* over Low shrubland and Scattered sedges and herbs

Condition: Good - Very Good

DOMINANT SPECIES	% COVER	HEIGHT (m)
Allocasuarina campestris	5	5
Allocasuarina huegeliana	5	5
Acacia neurophylla subsp. *erugata*	5	4
Grevillea hakeoides	5	1.5
Melaleuca cordata	10	1
Phebalium tuberculatum	5	1
Isopogon scabriusculus	1	1
Thryptomene kochii	1	1
Santalum acuminatum	5	2.5
Isopogon gardner	10	1.5 - 2
Neurachne alopecuroides	5	0.2

APPENDIX 3
TREES RATED AS SIGNIFICANT RECORDED IN DP 8

APPENDIX 3 TREES RATED AS SIGNIFICANT RECORDED IN DP 8

Species	Sign.	Easting (mE)	Northing (mN)	Distance from road (m)	CBH (cm)	ID
E. salmonophloia	M	628616	6518122	Between old rail & south boundary of private property	**79, 92**	**22**
E. salmonophloia	VH	628597	6518095		118, 164	23
E. salmonophloia	M	628589	6518083		125	24
E. salmonophloia	M	628592	6518084		137	25
E. salmonophloia	VH	628590	6518098		93, 152	26
E. salmonophloia	VH+	628596	6518057		144, 170	27
E. salmonophloia	M	628578	6518066		94	28
E. salmonophloia	M+	628582	6518110		84, 94	29
E. salmonophloia	M	628587	6518111		148	30
E. salmonophloia	M	628592	6518113		167	31
E. salmonophloia	M	628595	6518113		121	32
E. capillosa	M+	628258	6517865		182	33
E. salmonophloia	H			SLK 264.3		

* = introduced species

Sign. = Significance

- M = Medium (any *E. salmonophloia*)
- H = High (*E. salmonophloia* CBH>200 cm; *Eucalyptus salubris* >100 cm)
- VH = Very High (any tree CBH >200 cm)

CBH = Circumference at breast height

ID = number or identification code allocated to tree

APPENDIX 4
FAUNA SPECIES PREDICTED TO OCCUR IN DP 8

APPENDIX 4 FAUNA SPECIES PREDICTED TO OCCUR IN DP 8

E represents species listed under the Environment Protection and Biodiversity Conservation Act 1999
M represents migratory bird species listed under the Environment Protection and Biodiversity Conservation Act 1999
S represents species listed on the Department of Conservation and Land Management's Scheduled Fauna list
P represents species listed on the Department of Conservation and Land Management's Priority Fauna list
***** introduced species

FAUNA SPECIES PREDICTED TO OCCUR IN DP 8	STATUS
AMPHIBIANS	
***Hylidae* (Tree Frogs)**	
Western Banjo Frog *Limnodynastes dorsalis*	
***Myobatrachidae* (Ground Frogs)**	
Bleating Froglet *Crinia pseudinsignifera*	
Western Spotted Frog *Heleioporus albopunctatus*	
Turtle Frog *Myobatrachus gouldii*	
Kunapalari Frog *Neobatrachus kunapalari*	
Humming Frog *Neobatrachus pelobatoides*	
Guenther's Toadlet *Pseudophryne guentheri*	
REPTILES	
***Agamidae* (Dragons)**	
Ctenophorus cristatus	
Ctenophorus maculatus griseus	
Ctenophorus ornatus	
Ctenophorus reticulatus	
Moloch horridus	
Pogona minor minor	
Boidae (Pythons)	
Stimson's Python *Antaresia stimsoni stimsoni*	
Carpet Python *Morelia spilota imbricata*	S
***Elapidae* (Front-fanged Snales)**	
Brachyurophis semifasciata	
Demansia psammophis reticulata	
Parasuta gouldii	
Pseudechis australis	
Pseudonaja affinis affinis	
Pseudonaja nuchalis	
Simoselaps bertholdi	
***Gekkonidae* (Geckoes)**	
Christinus marmoratus	
Crenadactylus ocellatus ocellatus	
Diplodactylus granariensis	
Diplodactylus maini	
Diplodactylus pulcher	
Gehyra variegata	
Oedura reticulata	
Strophurus spinigerus	
Underwoodisaurus milii	
***Pygopodidae* (Legless Lizards)**	
Delma australis	
Delma fraseri	

	FAUNA SPECIES PREDICTED TO OCCUR IN DP 8	STATUS
	Lialis burtonis	
	Pygopus lepidopodus	
	***Scincidae* (Skinks)**	
	Cryptoblepharus plagiocephalus	
	Ctenotus impar	
	Ctenotus pantherinus	
	Ctenotus schomburgkii	
	Lerista distinguenda	
	Lerista macropisthopus	
	Lerista muelleri	
	Menetia greyii	
	Morethia butleri	
	Morethia lineoocellata	
	Morethia obscura	
	Tiliqua occipitalis	
	Tiliqua rugosa	
	***Typhlopidae* (Blind Snakes)**	
	Ramphotyphlops australis	
	Ramphotyphlops hamatus	
	Ramphotyphlops waitii	
	Varanidae (*Monitors*)	
	Varanus gouldii	
	Varanus tristis tristis	
	MAMMALS	
	***Bovidae* (Goats, Cattle, Sheep)**	
	Goat *Capra hircus*	*
	Cow *Bos taurus*	*
	Sheep *Oves aries*	*
	***Burramyidae* (Pygmy Possums)**	
	Western Pygmy Possum *Cercartetus concinnus*	
	***Canidae* (Dogs, Foxes)**	
	Fox *Vulpes vulpes* *	
	***Dasyuridae* (Dunnarts, Quolls, etc)**	
	Chuditch *Dasyurus geoffroii*	ES
	Kultarr *Antechinomys laniger*	
	Fat-tailed Dunnart *Sminthopsis crassicaudata*	
	Little Long-tailed Dunnart *Sminthopsis dolichura*	
	***Equidae* (Horses, Donkeys)**	
	Horse *Equus caballus*	*
	***Felidae* (Cats)**	
	Feral Cat *Felis catus*	*
	***Leporidae* (Rabbits)**	
	European Rabbit *Oryctolagus cuniculus*	*
	***Macropodidae* (Kangaroos and Wallabies)**	
	Western Grey Kangaroo *Macropus fuliginosus*	
	Euro *Macropus robustus erubescens*	
	Western Brush Wallaby *Macropus irma*	P
	***Molossidae* (Freetail Bats)**	
	White-striped Freetail Bat *Tadarida australis*	
	Western Freetail Bat *Mormopterus planiceps*	

FAUNA SPECIES PREDICTED TO OCCUR IN DP 8	STATUS
***Muridae* (Rodents)**	
House Mouse *Mus musculus*	*
Mitchell's Hopping Mouse *Notomys mitchelli*	
Ash-grey Mouse *Pseudomys albocinereus*	
Black Rat *Rattus rattus*	*
***Phalangeridae* (Possums)**	
Brushtail Possum *Trichosurus vulpecula*	
***Tachyglossidae* (Echidnas)**	
Short-beaked Echidna *Tachyglossus aculeatus*	
***Vespertilionidae* (Evening Bats)**	
Gould's Wattled Bat *Chalinolobus gouldii*	
Lesser Long-eared Bat *Nyctophilus geoffroyi*	
Greater Long-eared Bat *Nyctophilus timorensis*	
Southern Forest Bat *Vespadelus regulus*	
BIRDS	
***Acanthizidae* (Thornbills, Gerygones, Whitefaces, Wrens)**	
Inland Thornbill *Acanthiza apicalis*	
Yellow-rumped Thornbill *Acanthiza chrysorrhoa*	
Chestnut-tailed Thornbill *Acanthiza uropygialis*	
Slaty-backed Thornbill *Acanthiza robustirostris*	
Western Gerygone *Gerygone fusca*	
Redthroat *Pyrrholaemus brunneus*	
Weebill *Smicrornis brevirostris*	
***Accipitridae* (Eagles, Kites, Hawks, Bustards)**	
Brown Goshawk *Accipiter fasciatus*	
Collared Sparrowhawk *Accipiter cirrhocephalus cirrhocephalus*	
Wedge-tailed Eagle *Aquila audax audax*	
Little Eagle *Aquila morphnoides*	
Spotted Harrier *Circus assimilis*	
Black-shouldered Kite *Elanus axillaris*	
White-breasted Sea Eagle *Haliastur leucogaster*	
Whistling Kite *Haliastur sphenurus*	
Square-tailed Kite *Lophoictinia isura*	
***Aegothelidae* (Owlet-nightjars)**	
Australian Owlet-nightjar *Aegotheles cristatus cristatus*	
***Anatidae* (Ducks, geese, swans)**	
Grey Teal *Anas gracilis gracilis*	
Pacific Black Duck *Anas superciliosa*	
Australian Wood Duck *Chenonetta jubata*	
Australian Shelduck *Tadorna tadornoides*	
***Apodidae* (Swifts)**	
Fork-tailed Swift *Apus pacifcus*	EM
***Ardeidae* (Herons, Egrets, Bitterns)**	
White-faced Heron *Ardea novaehollandiae novaehollandiae*	
White-necked Heron *Ardea pacifica*	
Rufous Night Heron *Nycticorax caledonicus hilli*	
Artamidae (Woodswallows)	
Black-faced Woodswallow *Artamus cinereus*	
Dusky Woodswallow *Artamus cyanopterus*	
Masked Woodswallow *Artamus personatus*	

FAUNA SPECIES PREDICTED TO OCCUR IN DP 8	STATUS
***Burhinidae* (Stone-curlews)**	
Bush Stone-curlew *Burhinus grallarius*	P
***Campephagidae* (Cuckoo-shrikes, Cicadabirds, Trillers)**	
Black-faced Cuckoo-shrike *Coracina novaehollandiae*	
White-winged Triller *Lalage tricolor*	
Ground Cuckoo-shrike *Coracina maxima*	
***Caprimulgidae* (Nightjars)**	
Spotted Nightjar *Eurostopodus argus*	
***Climacteridae* (Treecreepers)**	
Rufous Treecreeper *Climacteris rufa*	
***Columbidae* (Doves, Pigeons)**	
Crested Pigeon *Ocyphaps lophotes*	
Rock Dove *Columbia livia*	*
Common Bronzewing *Phaps chalcoptera chalcoptera*	
Laughing Turtle-Dove *Streptopelia senegalensis*	*
Spotted Turtle-Dove *Streptopelia chineensis*	*
***Corvidae* (Crows, Ravens)**	
Little Crow *Corvus bennetti*	
Australian Raven *Corvus coronoides*	
***Cracticidae* (Magpies, Currawongs, Butcherbirds)**	
Pied Butcherbird *Cracticus nigrogularis*	
Australian Magpie *Cracticus tibicen*	
Grey Butcherbird *Cracticus torquatus torquatus*	
***Cuculidae* (Cuckoos)**	
Horsfield's Bronze Cuckoo*Chrysococcyx basalis*	
Shining Bronze-Cuckoo *Chrysococcyx lucidus*	
Fan-tailed Cuckoo *Cacomantis flabelliformis*	
Pallid Cuckoo *Cuculus pallidus*	
***Dicaeidae* (Mistletoes)**	
Mistletoebird *Dicaeum hirundinaceum hirundinaceum*	
Dicruridae (Drongos, Fantails, Willie Wagtails, Flycatchers)	
Magpie Lark *Grallina cyanoleuca*	
Grey Fantail *Rhipidura fuliginosa*	
Willie Wagtail *Rhipidura leucophrys leucophrys*	
***Falconidae* (Falcons, Hobbys, Kestrels)**	
Brown Falcon *Falco berigora berigora*	
Australian Hobby *Falco longipennis*	
Peregrine Falcon *Falco peregrinus*	S EM
Nankeen Kestrel *Falco cenchroides cenchroides*	
***Halcyonidae* (Wood Kingfishers, Kookaburras)**	
Laughing Kookaburra *Dacelo novaeguineae*	
Sacred Kingfisher *Todiramphus sanctus sanctus*	
***Hirundinidae* (Swallows, Martins)**	
Fairy Martin *Hirundo ariel*	
Tree Martin *Petrochelidon nigricans nigricans*	
Welcome Swallow *Hirundo neoxena*	
White-backed Swallow *Cheramoeca leucosternus*	
***Maluridae* (Emu-wrens, Fairy-wrens, Grass-wrens)**	

	FAUNA SPECIES PREDICTED TO OCCUR IN DP 8	STATUS
	Blue-breasted Fairy Wren *Malurus pulcherrimus*	
	Splendid Fairy-wren *Malurus splendens splendens*	
	***Megapodiidae* (Malleefowl, Scrubfowl)**	
	Malleefowl *Leipoa ocellata*	E S
	***Meliphagidae* (Honeyeaters, Chats, Friarbirds)**	
	Spiny-cheeked Honeyeater *Acanthagenys rufogularis*	
	Red Wattlebird *Anthochaera carunculata*	
	Crimson Chat *Epthianura tricolor*	
	White-fronted Chat *Epthianura albifrons*	
	White-eared Honeyeater *Lichenostomus leucotis leucotis*	
	Singing Honeyeater *Lichenostomus virescens*	
	Brown Honeyeater *Lichmera indistincta indistincta*	
	Yellow-throated Miner *Manorina flavigula*	
	Brown-headed Honeyeater *Melithreptus brevirostris*	
	White-fronted Honeyeater *Phylidonyris albifrons*	
	Tawny-crowned Honeyeater *Phylidonyris melanops*	
	***Meriopidae* (Bee-eaters)**	
	Rainbow Bee-eater *Merops ornatus*	EM
	Motacillidae (Pipits, True Wagtails)	
	Richard's Pipit *Anthus novaeseelandiae*	
	***Neosittidae* (Sitellas)**	
	Varied Sittella *Daphoenositta chrysoptera*	
	***Pachycephalidae* (Bellbirds, Shrike-thrushes, Whistlers)**	
	Grey Shrike-thrush *Colluricincla harmonica*	
	Rufous Whistler *Pachycephala rufiventris rufiventris*	
	Golden Whistler *Pachycephala pectoralis fuliginosa*	
	***Pardalotidae* (Pardalotes)**	
	Striated Pardalote *Pardalotus striatus*	
	***Passeridae* (Finches, Sparrows)**	
	Zebra Finch *Taeniopygia guttata*	
	***Petroicidae* (Flycatchers, Robins)**	
	Western Yellow Robin *Eopsaltria australis griseogularis*	
	Hooded Robin *Melanodryas cucullata cucullata*	
	Jacky Winter *Microeca fascinans assimilis*	
	Red-capped Robin *Petroica goodenovii*	
	***Podargidae* (Frogmouths)**	
	Tawny Frogmouth *Podargus strigoides*	
	***Pomotostomidae* (Babblers)**	
	White-browed Babbler (western Wheatbelt subspecies) *Pomatostomus superciliosus ashbyi*	P
	***Psittacidae* (Cockatoos, Parrots, Lorikeets)**	
	Galah *Cacatua roseicapilla*	
	Western Corella *Cacatua pastinator*	
	Carnaby's Cockatoo *Calyptorhynchus latirostris*	E S
	Purple-crowned Lorikeet *Glossopsitta porphyrocephala*	
	Budgerigar *Melopsittacus undulatus*	
	Mulga Parrot *Psephotus varius*	
	Elegant Parrot *Neophema elegans*	
	Cockatiel *Nymphicus hollandicus*	

	FAUNA SPECIES PREDICTED TO OCCUR IN DP 8	STATUS
	Australian Ringneck *Platycercus zonarius*	
	Western Rosella *Platycercus icterotis*	
	Regent Parrot *Polytelis anthopeplus anthopeplus*	
	***Rallidae* (Coots, Crakes, Moorhens, Rails)**	
	Eurasian Coot *Fulica atra*	
	Black-tailed Native-hen *Gallinula ventralis*	
	***Strigidae* (Owls, Hawk-owls)**	
	Boobook Owl *Ninox novaeseelandiae ocellata*	
	***Sylviidae* (Cisticolas, Grassbirds, Songlarks)**	
	Brown Songlark *Cincloramphus cruralis*	
	Rufous Songlark *Cincloramphus mathewsi*	
	***Turnicidae* (Button-quails)**	
	Painted Button-quail *Turnix varia varia*	
	Little Button-quail *Turnix velox*	
	***Tytonidae* (Owls)**	
	Barn Owl *Tyto alba delicatula*	
	***Zosteropidae* (White-eyes)**	
	Silvereye *Zosterops lateralis gouldi*	

APPENDIX 5

Report (Quartermaine Consultants) on a Preliminary Archeological Investigation for Aboriginal Sites and Aboriginal Sites Registered on the Department of Indigenous Affairs Database on 22nd December 2005

QUARTERMAINE CONSULTANTS

REPORT ON A PRELIMINARY ARCHAEOLOGICAL INVESTIGATION FOR ABORIGINAL SITES GREAT EASTERN HIGHWAY ROAD WORKS PROJECT KELLERBERRIN TO CARRABIN SECTION

Prepared for ATA Evironmental

by G.S. Quartermaine

January 2006

REPORT ON A PRELIMINARY ARCHAEOLOGICAL INVESTIGATION FOR ABORIGINAL SITES GREAT EASTERN HIGHWAY ROAD WORKS PROJECT KELLERBERRIN TO CARRABIN SECTION

Prepared for ATA Environmental

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January 2005

REPORT ON A PRELIMINARY ARCHAEOLOGICAL INVESTIGATION FOR ABORIGINAL SITES GREAT EASTERN HIGHWAY ROAD WORKS PROJECT KELLERBERRIN TO CARRABIN SECTION

Prepared for ATA Environmental

by G.S. Quartermaine

ABSTRACT

A preliminary archaeological investigation for Aboriginal heritage significance of the area of proposed road works for the Great Eastern Highway road works project, between Kellerberrin and Carrabin in the Eastern Agricultural Area of Western Australia, was commissioned by ATA Environmental.

The objectives of this investigation were to facilitate planning of the proposed road works programme. This was completed by the assembly of information from previous work in the region, including Department of Indigenous Affairs Aboriginal register list and site files, survey reports and other relevant literature, maps and site plans, site photographs, and environmental information.

As a result of previous surveys and independent research, it was established that six archaeological sites of Aboriginal origin have been recorded and registered with the DIA within a five kilometre radius of the area of proposed road works. These include four painting sites, a possible engraved stone, and a burial site. None are within the area of the proposed road works and the closest is over one kilometre from the highway.

The previous research and survey work, coupled with the narrow width and disturbed existing environment of the project area, indicates a low potential for the presence of Aboriginal sites within that area. No further Aboriginal heritage work is considered to be warranted.

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Background

A preliminary archaeological investigation ("desktop study") for Aboriginal heritage significance of the area of proposed road works for the Great Eastern Highway road widening, repaving and realignment project, between Kellerberrin and Carrabin in the Eastern Agricultural Area of Western Australia, was commissioned by ATA Environmental.

The investigation was carried out by Quartermaine Consultants in January, 2006. The work was undertaken by Gary Quartermaine, BA Honours (Anthropology and Archaeology), who has undertaken archaeological investigations throughout the state. This was undertaken in conjunction with the ethnographic component of the investigation, reported upon separately, which was conducted by R & E O'Connor Pty Ltd.

The objective was to conduct an investigation to facilitate planning of the proposed road works. The investigation involved the assembly of data from previous work in the region, including information from the Heritage and Culture Division, Department of Indigenous Affairs (DIA) Aboriginal site register and files, previous survey reports and other relevant literature, maps and environmental information.

1.2 Location

The project is for proposed road works for the Great Eastern Highway road widening, repaving and realignment project, between Kellerberrin and Carrabin, in the Eastern Agricultural Area of Western Australia. It involves 79.25 kilometres of the Great Eastern Highway between 198.40 and 300.00 SLK as listed below. See also Figures 1 and 2a-e.

DESIGN PACKAGES

Design Package	From (SLK)	To (SLK)	Length (km)	Possible Treatment	Description and Potential Issues
DP 1	239.2	245.2	6.0	Re-Condition / Widen /Overlay	N/A
DP 2	251.6	256.25	4.65	Widen Shoulders to 11 metres	N/A
DP2a	256.25	258.05	1.8	Kerbing & Pavement Marking	N/A
DP 3	247.2	251.6	4.4	Realignment	Cahills Realignment
DP 4	267.0	278.9	11.9	Re-Condition / Widen /Overlay	No Land Acquisitions
DP 5	280.6	290.1	9.5	Widen / Overlay / Rail Overpass	No Land Acquisitions
DP 6	226.9	239.2	12.3	Widen/Overlay	Baandee - Hines Hill
DP 7	245.2	246.1	2.5	Realignment	Nangeen Realignment
DP 8	264.6	267	2.4	Realignment	Booran Deviation
DP 9	278.9	280.6	1.7	Realignment	Burracoppin Realignment
DP 10	257.8	264.8	8.8	Widen	Includes 'A' Class Reserve
DP 11	198.4	203.65	3.4	Townsite & Intersections	Kellerberrin Townsite
DP 12	290.1	300	9.9	Widen & Overlay	Walgoolan - Carrabin

2.0 ABORIGINAL SITE CONTEXT

2.1 Introduction

The principal aim of an archaeologist is to describe and explain past ways of life with reference to material culture. The general focus of Australian Aboriginal archaeological research has been to describe and explain the history of the occupation of the continent, examining cultural change and adaptations to develop explanatory models to describe how and why the occupation of the Australian continent proceeded. Anthropologists document sites of significance to living Aboriginal people.

2.2 Site Definitions

Sites of significance to Aboriginal people include mythological, ceremonial and burial sites as well as named places and other known places, such as water sources.

Aboriginal material culture is based, to a large extent, on non-durable materials; such as wood, bark, fibre and skins; that have a limited life in the archaeological record. Stone tools, conversely, remain as often the only evidence of prehistoric activity. Bone; either as a tool, as refuse, or as a burial; falls somewhere between these extremes. Lofgren (1975:7) describes spears, spear-throwers and clubs for men, and digging sticks, wooden carrying dishes and grindstones for women, as the basic implements of Aboriginal life.

Therefore, stone artefact sites reflect only one aspect of Aboriginal material culture which utilised a wide range of materials from the natural environment.

For the purpose of this investigation, an archaeological site is defined as "any place containing traces of past human activity" (Fagan, 1980:7). This is manifested in a number of different site components which may occur singularly or with one or more of the others to form an archaeological site. The most common of these are surface artefact scatters, quarries, art sites, stone arrangements, rock shelters with evidence of occupation, grinding patches, shell middens, burials and marked trees.

The above definition of archaeological sites is a scientific definition. However, registered Aboriginal sites may not meet the scientific criteria on all occasions. The assessment as to whether such sites are covered by the provisions of the W.A. *Aboriginal Heritage Act*, 1972, Section 5, is made for the Minister for Indigenous Affairs by the Aboriginal Cultural Material Committee. Such assessment is usually undertaken as part of a Section 18 application for site disturbance.

An Aboriginal archaeological site is mentioned in the WA *Aboriginal Heritage Act*, 1972, in Section 5 (c), which reads:

"Any place which, in the opinion of the Committee is, or was, associated with the Aboriginal people and which is of historical, anthropological, archaeological or ethnographical interest and should be preserved because of its importance and significance to the cultural heritage of the state."

In order to address the state legislation and in the absence of any guidance from DIA despite several enquiries over the past twenty years, an artefact scatter is recorded as a site by this consultant if it contains a concentration of artefacts in contextual association, three or more with a density of at least 1/100m^2. Areas of solitary artefacts, called Isolated Finds, are presently recorded but not registered as Aboriginal sites. This was not always the case in the past and some previously registered sites contain only a solitary artefact, in keeping with the broad scientific definition.

2.3 Archaeological Background

The earliest evidence for prehistoric occupation of the South-West of Australia is dated at 38,000 years ago, for a stratified site at Upper Swan, located 25 km northeast of Perth (Pearce and Barbetti, 1981). Two other sites in the south-west have also yielded Pleistocene dates, Devil's Lair and Helena River (Dortch and Merrilees, 1973; Schwede, 1983).

The earliest occupation dates for inland Western Australia are in the order of 20,000 years ago and these were obtained from rockshelter deposits near Newman (Maynard, 1980; and Troilett, 1982) and Pannawonica (Hughes and Quartermaine, 1992). A 10,000 year old occupation of a rockshelter site, Puntutjarpa, near Warburton, has been described by Gould (1977), with continuous occupation into the present.

Prehistoric stone tool industries in the South-West have been classified into earlier and later phases (Dortch, 1977). The early phase industries have only been documented from a few well-dated sites. They include small thick flake scrapers, bipolar cores, notched-denticulated pieces, flakes from discoidal cores, and single and multi-platform cores. These artefacts have been manufactures from a range of lithic materials, including quartz, dolerite, chert and silcrete.

Later phase stone industries, generally found in archaeological contexts dating from 4,000 years ago, include the addition of geometric microliths, backed blades, and a variety of adze flakes, which are part of the Australian "small tool tradition" (Dortch, 1977; Mulvaney, 1975).

The surface artefact scatter sites previously recorded in the wheatbelt are mostly low density scatters with few artefacts present. Quartz and dolerite flakes are the dominant type of artefact but also recorded are scrapers, cores, grinding stone fragments and chips and pieces (see Anderson, 1981; O'Connor, Quartermaine and Bodney, 1988).

Several of these sites contain less than five artefacts and have been recorded on topographic grounds (Anderson, 1981:5). They are often in disturbed contexts and Anderson (1981:5) also notes that easily identifiable artefacts have been collected by landowners and others over the years.

The margins of watercourses are the most likely locations of larger archaeological sites, as in other parts of the state, and only small sites are expected away from these areas. Rock outcrops may also contain archaeological evidence in the form of paintings, stone arrangements or artefact scatters. These are often associated with gnamma (water) holes.

The paucity of Aboriginal sites recorded in this region is probably as much the result of limited investigation as any other factor, although it is not an area of high site discovery potential.

Research in the wider region of the eastern agricultural area provides some details of the archaeological signature of the area and the chronology of Aboriginal settlement (Macintyre, et al, 1993; Macintyre, et al, 1994; Harris, 1995; Quartermaine, 1996, 2001a, 2001b, 2003, 2004; Webb, 2003). Typically, these surveys have located little or no archaeological material, establishing that the archaeological record has been compromised.

2.4 The Nature and Locations of Aboriginal Sites

Commercial surveys and academic research have shown that the most common sites in the West Coastal Region are artefact scatters, burial sites, quarries, and scarred trees. Stone arrangements associated with ceremonial sites are also known. It is evident that larger occupation sites are associated with fresh water sources. The preceding data provides a basis for predicting the occurrence of sites, assuming resources as the principal factor in site location. The site types which can be expected to occur in the project area are:

1) Camp sites - small scatters, including brief or sporadic occupation, may occur at task specific sites or ephemeral water sources. Generally these small sites are interpreted as representing ephemeral "dinnertime" camps or task specific sites associated with the daily foraging activities of prehistoric groups. Large sites with high artefact densities commonly occur on the margins of permanent or semi-permanent water sources. These sites typically represent campsite locations that were repeatedly occupied, sometimes for prolonged periods.

2) Quarry sites - artefacts, including debitage, flakes and cores, may occur at sources of knappable stone;

3) Reduction sites - these sites, with evidence of the manufacture of stone tools or forming of blanks for tool production elsewhere, may occur near quarry sites;

4) Rockshelters and caves - cavities or rock overhangs may contain stone tools on the floor or slope below, or other evidence of Aboriginal occupation;

5) Stone arrangements - placed stones, forming lines or patterns, or standing stones;

6) Art sites - might be associated with rockshelters or rock outcrops and include both paintings and engravings;

7) Gnamma Holes- often occur in exposed rock surfaces as may be associated with stone arrangements, which serve as sign-posts to water supplies;

8) Burial Sites - usually located with ethnographic information, and virtually impossible to detect without excavation unless they are exposed;

9) Scarred Trees - resulting from bark removal for carrying bowls, shields and spear throwers, such sites are probably under represented owing to the lack of preservation; and

10) Grinding Patches - found on rock outcrops and exposures, often near water, and usually associated with seed grinding activities.

3.0 RESULTS

3.1 Investigation Methodology

The Western Australian *Aboriginal Heritage Act*, 1972, makes provision ... "... for the preservation on behalf of the community of places and objects customarily used by or traditional to the original inhabitants of Australia or their descendants, or associated therewith, and for other purpose incidental thereto." The Act defines the obligations of the community relating to sites (Sections 15-18, see Appendices 1 and 2).

The research involved familiarisation with DIA Aboriginal Site register and files, previous survey reports and other relevant literature, plus maps and environmental information for the area under investigation.

The tasks undertaken were as follows:-

1. To document any Aboriginal sites located in the project area and assess their significance;

2. To map those sites on appropriate scale;

3. To check survey reports and other literature covering sites and surveys in the project area.

3.2 Aboriginal Site Register

The W.A. *Aboriginal Heritage Act*, 1972 (as amended), is administered by the Department of Indigenous Affairs' Division of Heritage and Culture. The DIA maintains a Register in the form of a computerised data base of reported Aboriginal sites. Each registered Aboriginal site is designated by a numerical site id, site type (e.g. engravings, ceremonial, artefacts, etc), site name and its position is recorded by the Map Grid of Australia 1994 (MGA94) coordinates related to the Geocentric Datum of Australia 1994 (GDA94), as well as Longitude and Latitude.

Although the grid references are given in MGA94/GDA94 coordinates, many of these sites were recorded in the period when imperial grid references were used. Since their recording, the grid references have been changed to the metric system on AGD66 then to AGD84 and finally to GDA94.

Given that there was likely to be some errors in any imperial recordings, the transfer to the present system may have resulted in further errors in site location coordinates over the various stages. Field verification is, therefore, required to determine the correct site location for any sites near the project area if there is insufficient information in the individual sites files to establish the actual location of the site.

As a result of previous surveys and independent research, it was established that six archaeological sites of Aboriginal origin have been recorded and registered with the DIA within a five kilometre radius of the area of proposed road works. These include four painting sites, a possible engraved stone, and a burial site. None are within the area of the proposed roadworks and the closest is over one kilometre from the highway.

DIA id 5069 is registered as a painting site. The paintings are red hand stencils and white emu tracks in a cave on a granite outcrop and nearby boulders. There is an associated gnamma hole that has been filled in. It is located approximately four kilometres north of the highway (DIA site files). The site file sketch map indicates that it is located at Jureen Rock and is most likely the same site as DIA id 15140.

DIA id 5070 is described as a burial site near the old mission building site which is located near the corner of Mission Road and Goldfields Road to the north-east of Jureen Rock.

DIA id 5071 is a ceremonial area with an associated painting site. It is to the north of DIA id 5070 on the north side of the Goldfields Road near Mooranoppin Spring.

DIA id 5604 is a painting site situated 2.5 kilometres east-north-east of Doodlakine. No further information is available in the site file.

DIA id 5605 is registered as a stone with a footprint on it. The stone has been moved to the local farm house. The registered location is not near the proposed road works (DIA site files). It is considered that this site is rather dubious and probably not of Aboriginal origin.

Descriptions of the few sites listed in the region are sparse. This is the result of miscellaneous recordings by farmers and other interested people, some time ago, before more precise recording methods became *de rigeur*. One explanation for the low number of sites recorded in the wider region may be that intensive farming and other developments in the region over time and associated infrastructure may have destroyed evidence of sites as was proposed earlier in regard to the corridor.

TABLE 1: Registered Aboriginal Sites

DIA id	DIA Site No	Grid Ref MGA94	Site Type	Site Name
5069	S00096	571640.6505649	Painting	Mooranoppin Rock
5070	S00097	571640.6505649	Burial	Old Jiriny Mission
5071	S00098	571640.6505649	Painting	Shark Mouth, Kellerberrin
5604	S00548	582640.6502649	Painting	Doodlakine
5605	S00549	635141.6525149	Artefact	Talgamine Rock
15140	S03044	573240.6503249	Painting	Jureen Rock

3.3 Previous Archaeological Investigations

Previous Aboriginal heritage investigations have resulted in a full coverage of the area of the proposed road works.

An investigation for Aboriginal sites examined the section between Cunderdin and Walgoolan, 259.00 and 288.20 SLK, for proposed upgrading of the Great Eastern Highway (Macintyre, Dobson and Quartermaine, 1994). No archaeological sites were located in designated survey corridor as a result of the field survey.

An archaeological survey covered the section between Walgoolan and Southern Cross – 288.2 to 366.43 SLK - for road works on the Great Eastern Highway and bridge works at Moorine Rock (Harris, 1995). No archaeological sites were located in designated survey corridor as a result of the field survey.

Recently, an archaeological investigation for Aboriginal sites covered the section between 259 and 291 SLK on the Great Eastern Highway for a road widening project. This involved a research and field inspection programme (Quartermaine, 2003). No archaeological sites were located in designated survey corridor as a result of the field survey.

An archaeological review of the section between Hines Hill and Southern Cross, 234.30 to 364.80 SLK, found there were no archaeological sites in conflict with the proposed roadworks and that further archaeological work was not considered to be warranted.

Other surveys near the project area have been for power line alignments (Quartermaine, 2001a, 2001b), optic fibre cable alignments (Webb, 2003), and mining projects (Macintyre, et al, 1993; Quartermaine, 1996). None of these surveys located archaeological sites that are near the proposed road works.

4.0 CONCLUSIONS

4.1 Discussion

A preliminary archaeological investigation ("desktop study") for Aboriginal heritage significance of the area of proposed road works for the Great Eastern Highway road widening, repaving and realignment project, between Kellerberrin and Carrabin in the Eastern Agricultural Area of Western Australia, was commissioned by ATA Environmental.

The project is for proposed road works for the Great Eastern Highway road widening project, between Kellerberrin and Carrabin in the Eastern Agricultural Area of Western Australia. It involves 79.25 kilometres of the Great Eastern Highway between 198.40 and 300.00 SLK.

The preliminary investigation involved a review of data from previous work in the region, including information from the Heritage and Culture Division, Department of Indigenous Affairs (DIA) Aboriginal site register and files, previous survey reports and other relevant literature, maps and environmental information.

As a result of previous surveys and independent research, it was established that six archaeological sites of Aboriginal origin have been recorded and registered with the DIA within a five kilometre radius of the area of proposed road works. These include four painting sites, a possible engraved stone, and a burial site. None are within the area of the proposed roadworks and the closest is over one kilometre from the highway.

Previous Aboriginal heritage investigations have resulted in a full coverage of the area of the proposed road works. No archaeological sites were located in the designated project corridor as a result of any of these surveys.

The previous research and survey work, coupled with the narrow width and disturbed existing environment of the project area, indicates a low potential for the presence of Aboriginal sites within that area. No further Aboriginal heritage work is considered to be warranted.

4.2 Recommendations

The recommendations which follow are based on previous field observations and research.

1. It is recommended that, where possible, activities be directed to avoid disturbing Aboriginal sites.

2. In the light of the present investigation, given the previous research and survey work, coupled with the narrow width and disturbed existing environment of the project area, it is considered that no further Aboriginal heritage work is warranted.

3. It is pointed out that human interference to Aboriginal sites is an offence, unless authorised under the Act, as outlined in Section 17 of the W.A. *Aboriginal Heritage Act*, 1972. Therefore, it is recommended that the Proponent take adequate measures to inform any project personnel of this requirement.

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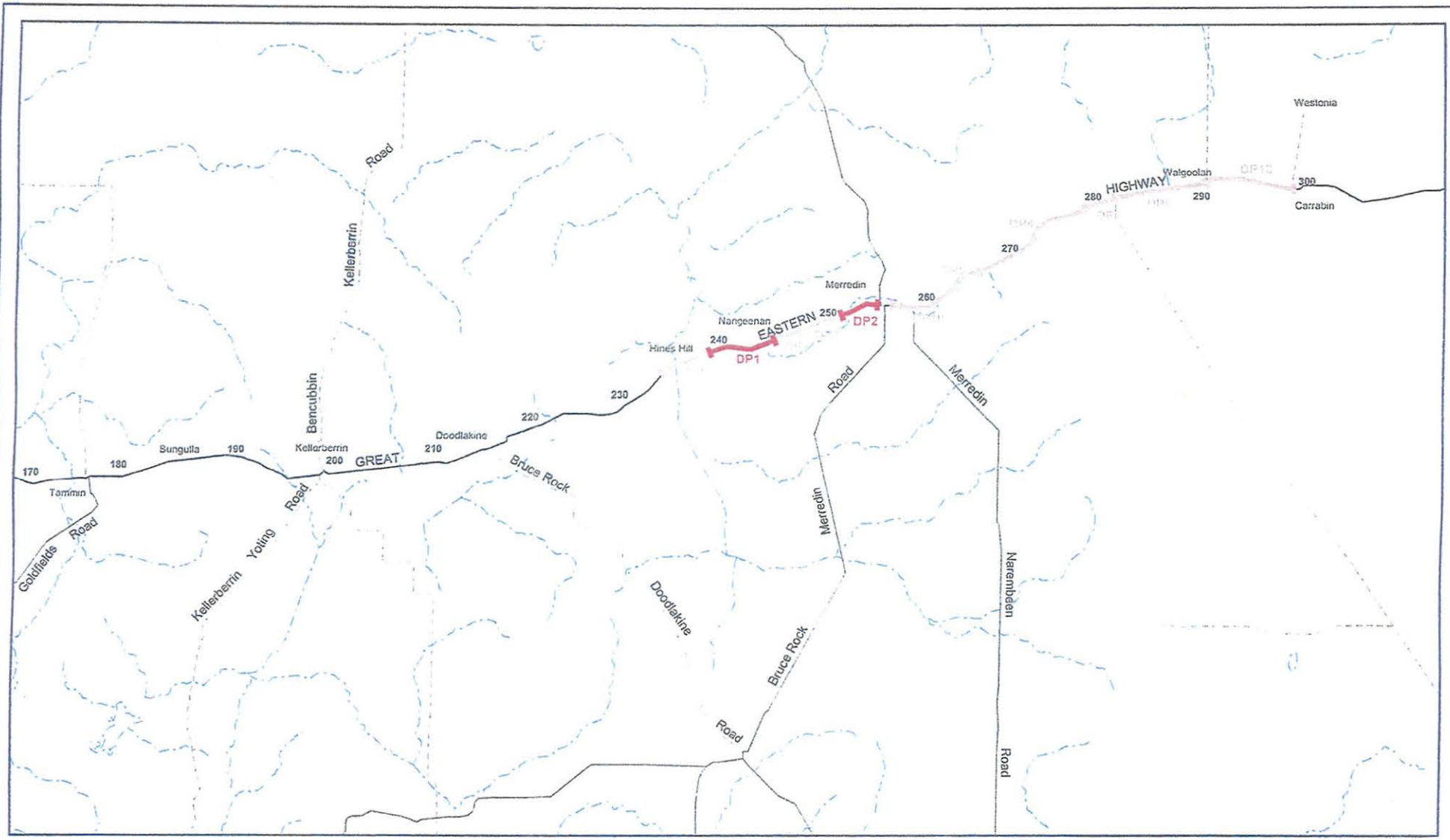
Figure 1: Location Plan



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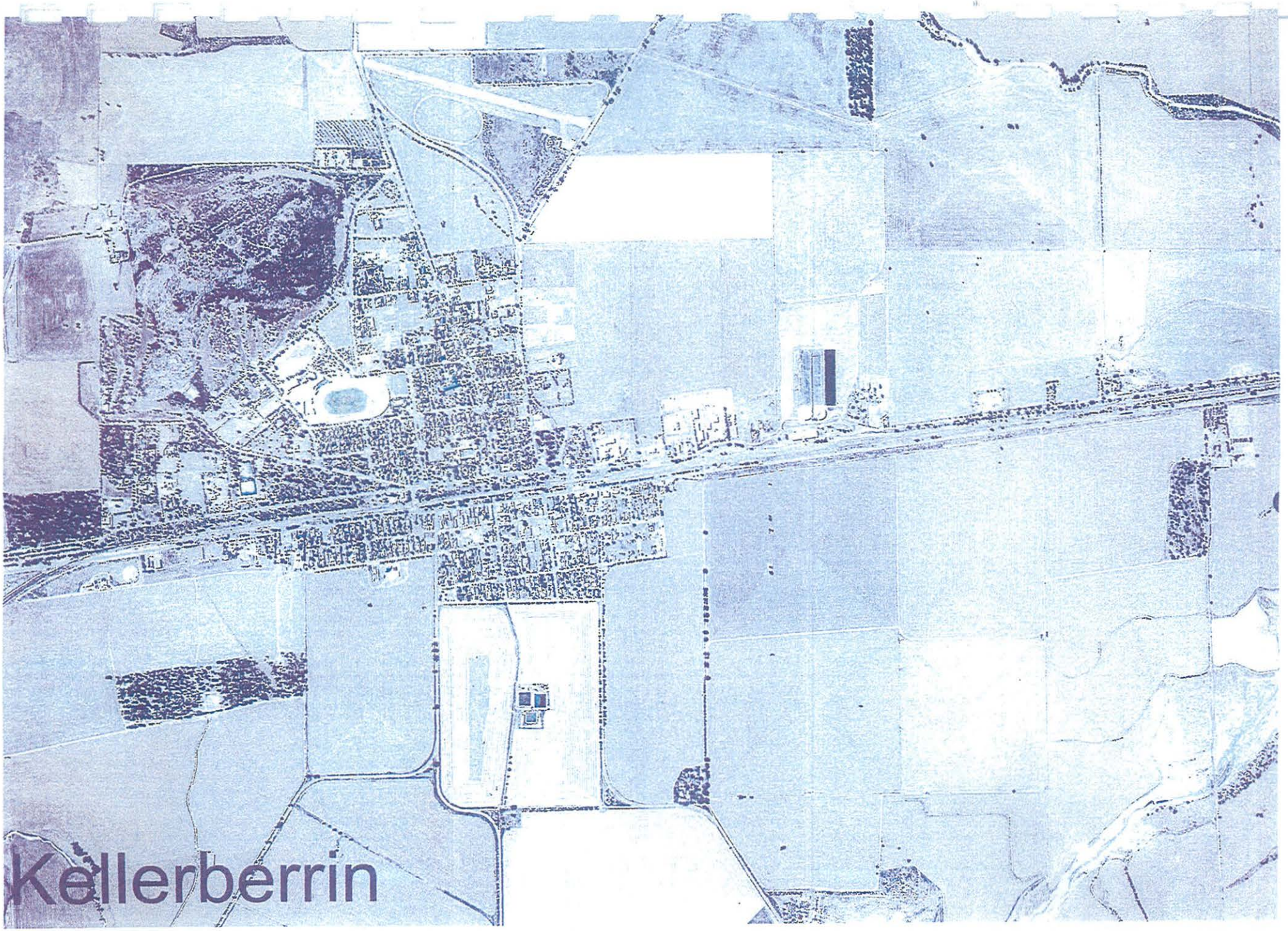
ATA Environmental
environmental scientists

GREAT EASTERN HIGHWAY UPGRADE
TAMMIN - WALGOOLAN, DESIGN PACKAGE 1 & 2

REGIONAL LOCATION

FIGURE 1

Figure 2a-e: Proposed Roadworks


Kellerberrin

APPENDIX 1

OBLIGATIONS RELATING TO SITES UNDER THE ABORIGINAL HERITAGE ACT, 1972

Report of Findings

"15. Any person who has knowledge of the existence of anything in the nature of Aboriginal burial grounds, symbols or objects of sacred, ritual of ceremonial significance, cave or rock paintings or engravings, stone structures or arranged stones, carved trees, or of any other place or thing to which this Act applies or to which this Act might reasonably be suspected to apply shall report its existence to the Registrar, or to a police officer, unless he has reasonable cause to believe the existence of the thing or place in question to be already known to the Registrar."

Excavation of Aboriginal Sites

"16. (1) Subject to Section 18, the right to excavate or to remove any thing from an Aboriginal site is reserved to the Registrar.

(2) The Registrar, on the advice of the Committee, may authorise the entry upon and excavating of an Aboriginal site and the examination or removal of any thing on or under the site in such manner and subject to such conditions as the Committee may advise."

Offences Relating to Aboriginal Sites

"17. A person who-

(a) Excavates, destroys, damages, conceals or in any way alters any Aboriginal site; or

(b) In any way alters, damages, removes, destroys, conceals, or who deals with in a manner not sanctioned by relevant custom, or assumes the possession, custody or control of, any object on or under an Aboriginal site,

commits an offence unless he is acting with the authorisation of the Registrar under Section 16 or the consent of the Minister under Section 18."

Consent to Certain Uses

"18. (1) For the purposes of this section, the expression "the owner of any land" includes a lessee from the Crown, and the holder of any mining tenement or mining privilege, or of any right or privilege under the Petroleum Act, 1967, in relation to the land.

(2) Where the owner of any land gives to the Trustees notice in writing that he requires to use the land for a purpose which, unless the Minister gives his consent in this Section, would be likely to result in a breach of Section 17 in respect of any Aboriginal site that might be on the land, the Committee shall, as soon as they are reasonably able, form an opinion as to whether there is any Aboriginal site on the land, evaluate the importance and significance of any such site, and submit the notice to the Minister together with their recommendations in writing as to whether or not the Minister should consent to the use of the land for that purpose, and, where applicable, the extent to which and the conditions upon which his consent should be given.

(3) When the Committee submit a notice to the Minister under subsection (2) of this section he shall consider their recommendation and having regard to the general interest of the community shall either -

(a) Consent to the use of the land the subject of the notice, or a specified part of the land, for the purpose required, subject to such conditions, if any, as he may specify; or

(b) Wholly decline to consent to the use of the land the subject of the notice for the purpose required,

and shall forthwith inform the owner in writing of his decision.

(4) Where the owner of any land has given to the Committee notice pursuant to the subsection (2) of this section and the Committee have not submitted it with their recommendation to the Minister in accordance with that subsection the Minister may require the Committee to do so within a specified time, or may require the Trustees to take such other action as the Minister considers necessary in order to expedite the matter, and the Committee shall comply with any such requirement.

(5) Where the owner of any land is aggrieved by a decision of the Minister made under subsection (3) of this section he may, within the time and in the manner prescribed by the rules of court, appeal from the decision of the Minister to the Supreme Court which may hear and determine an appeal.

(6) In determining an appeal under subsection (5) of this section the Judge hearing the appeal may confirm or vary the decision of the Minister against which the appeal has been made or quash the decision of the Minister, and may make such order as to the costs of the appeal as he sees fit.

(7) Where the owner of the any land gives notice to the Committee under subsection (2) of this section, the Committee may if they are satisfied that it is practicable to do so, direct the removal of any object to which this Act applies from the land to a place of safe custody.

(8) Where consent has been given under this section to a person to use any land for a particular purpose nothing done by or on behalf of that person pursuant to, and in accordance with any conditions attached to, the consent constitute an offence against the Act."

APPENDIX 2

Notes on the Recognition of Aboriginal Sites

There are various types of Aboriginal Sites, and these notes have been prepared as a guide to the recognition of those types likely to be located in the survey area.

An Aboriginal Site is defined in the Aboriginal Heritage Act, 1972, in Section 5 as:

"(a) Any place of importance and significance where persons of Aboriginal descent have, or appear to have, left any object, natural or artificial, used for, or made for or adapted for use for, any purpose connected with the traditional cultural life of the Aboriginal people, past or present;

(b) Any sacred, ritual or ceremonial site, which is of importance and special significance to persons of Aboriginal descent;

(c) Any place which, in the opinion of the Committee is or was associated with the Aboriginal people and which is of historical, anthropological, archaeological or ethnographical interest and should be preserved because of its importance and significance to the cultural heritage of the state;

(d) Any place where objects to this Act applies are traditionally stored, or to which, under the provisions of this Act, such objects have been taken or removed."

Habitation Sites

These are commonly found throughout Western Australia and usually contain evidence of tool-making, seed grinding and other food processing, cooking, painting, engraving or numerous other activities. The archaeological evidence for some of these activities is discussed in details under the appropriate heading below.

Habitation sites are usually found near an existing or former water source such as a gnamma hole, rock pool, spring or soak. They are generally in the open, but they sometimes occur in shallow rock shelters or caves. It is particularly important that none of these sites be disturbed as the stratified deposits which may be found at such sites can yield valuable information about the inhabitants when excavated by archaeologists.

Seed Grinding

Polished or smoothed areas are sometimes noticed on/near horizontal rock surfaces. The smooth areas are usually 25cm wide and 40 or 50cm long. They are the result of seed grinding by the Aboriginal women and indicate aspects of past economy.

Habitation Structures

Aboriginal people sheltered in simple ephemeral structures, generally made of branches and sometimes of grass. These sites are rarely preserved for more than one occupation period. Occasionally rocks were pushed aside or used to stabilise other building materials. When these rocks patterns are located they provide evidence for former habitation sites.

Middens

When a localised source of shellfish and other foods has been exploited from a favoured camping place, the accumulated ashes, hearth stones, shells, bones and other refuse can form mounds at times several metres high and many metres in diameter. Occasionally these refuse mounds or middens contain stone, shell or bone tools. These are most common near the coast, but examples on inland lake and river banks are not unknown.

Stone Artefact Factory Sites

Pieces of rock from which artefacts could be made were often carried to camp sites or other places for final production. Such sites are usually easily recognisable because the manufacturing process produces quantities of flakes and waste material which are clearly out of context when compared with the surrounding rocks. All rocks found on the sandy coastal plain, for example, must have been transported by human agencies. These sites are widely distributed throughout the State.

Quarries

When outcrops of rock suitable for the manufacture of stone tools were quarried by the Aborigines, evidence of the flaking and chipping of the source material can usually be seen in situ and nearby. Ochre and other mineral pigments used in painting rock surfaces, artefacts and in body decoration are mined from naturally occurring seams, bands and other deposits. This activity can sometimes be recognised by the presence of wooden digging sticks or the marks made by these implements.

Marked Trees

Occasionally trees are located that have designs in the bark which have been incised by Aborigines. Toeholds, to assist the climber, were sometimes cut into the bark and sapwood of trees in the hollow limbs of which possums and other arboreal animals sheltered. Some tree trunks bear scars where section of bark or wood have been removed and which would have been used to make dishes, shield, spearthrowers and other wooden artefacts. In some parts of the state wooden platforms were built in trees to accommodate a corpse during complex rituals following death.

Burials

In the north of the state, it was formerly the custom to place the bones of the dead on a ledge in a cave after certain rituals were completed. The bones were wrapped in sheets of bark and the skull placed beside this. In other parts of Western Australia the dead were buried, the burial position varying according to the customs of the particular area and time. Natural erosion, or mechanical earthmoving equipment occasionally exposes these burial sites.

Stone Structures

If one or more stone are found partly buried or wedged into a position which is not likely to be the result of natural forces, then it is probable that the place is an Aboriginal site and that possibly there are other important sites nearby. There are several different types of stone arrangements ranging simple cairns or piles of stones to more elaborate designs.

Low weirs which detain fish when tides fall are found in coastal areas. Some rivers contain similar structures that trap fish against the current. It seems likely that low stone slab structures in the south west jarrah forests were built to provide suitable environments in which to trap some small animals. Low walls or pits were sometimes made to provide a hide or shelter for a hunter.

Elongated rock fragments are occasionally erected as a sign or warning that a special area is being approached. Heaps or alignments of stones may be naturalistic or symbolic representations of animals, people or mythological figures.

Paintings

These usually occur in rock shelters, caves or other sheltered situations which offer a certain degree of protection from the weather. The best known examples in Western Australia occur in the Kimberley region but paintings are also found through most of the states. One of several coloured ochres as well as other coloured pigments may have been used at a site. Stencilling was a common painting technique used throughout the state. The negative image of an object was created by spraying pigment over the object which was held against the wall.

Engravings

This term described designs which have been carved, pecked or pounded into a rock surface. They form the predominant art form of the Pilbara region but are known to occur in the Kimberleys in the north to about Toodyay in the south. Most engravings occur in the open, but some are situated in rock shelters.

Caches

It was the custom to hide ceremonial objects in niches and other secluded places. The removal of objects from these places, or photography of the places or objects or any other interference with these places is not permitted.

Ceremonial Grounds

At some sites the ground has been modified in some way by the removal of surface pebbles, or the modelling of the soil, or the digging of pits and trenches. In other places there is not noticeable alteration of the ground surface and Aborigines familiar with the site must be consulted concerning its location.

Mythological Sites

Most sites already described have a place in Aboriginal mythology. In addition there are many Aboriginal sites with no man-made features which enable them to be recognised. They are often natural features in the landscape linked to the Aboriginal Account of the formation of the world during the creative "Dreaming" period in the distant past. Many such sites are located at focal points in the creative journeys of mythological spirit beings of the Dreaming. Such sites can only be identified by the Aboriginal people who are familiar with the associated traditions.

APPENDIX 3

SITE REGISTER LIST

Search Criteria

6 sites in local government area 'Kellerberrin'.

Disclaimer

Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist. Consultation with Aboriginal communities is on-going to identify additional sites. The AHA protects all Aboriginal sites in Western Australia whether or not they are registered.

Copyright

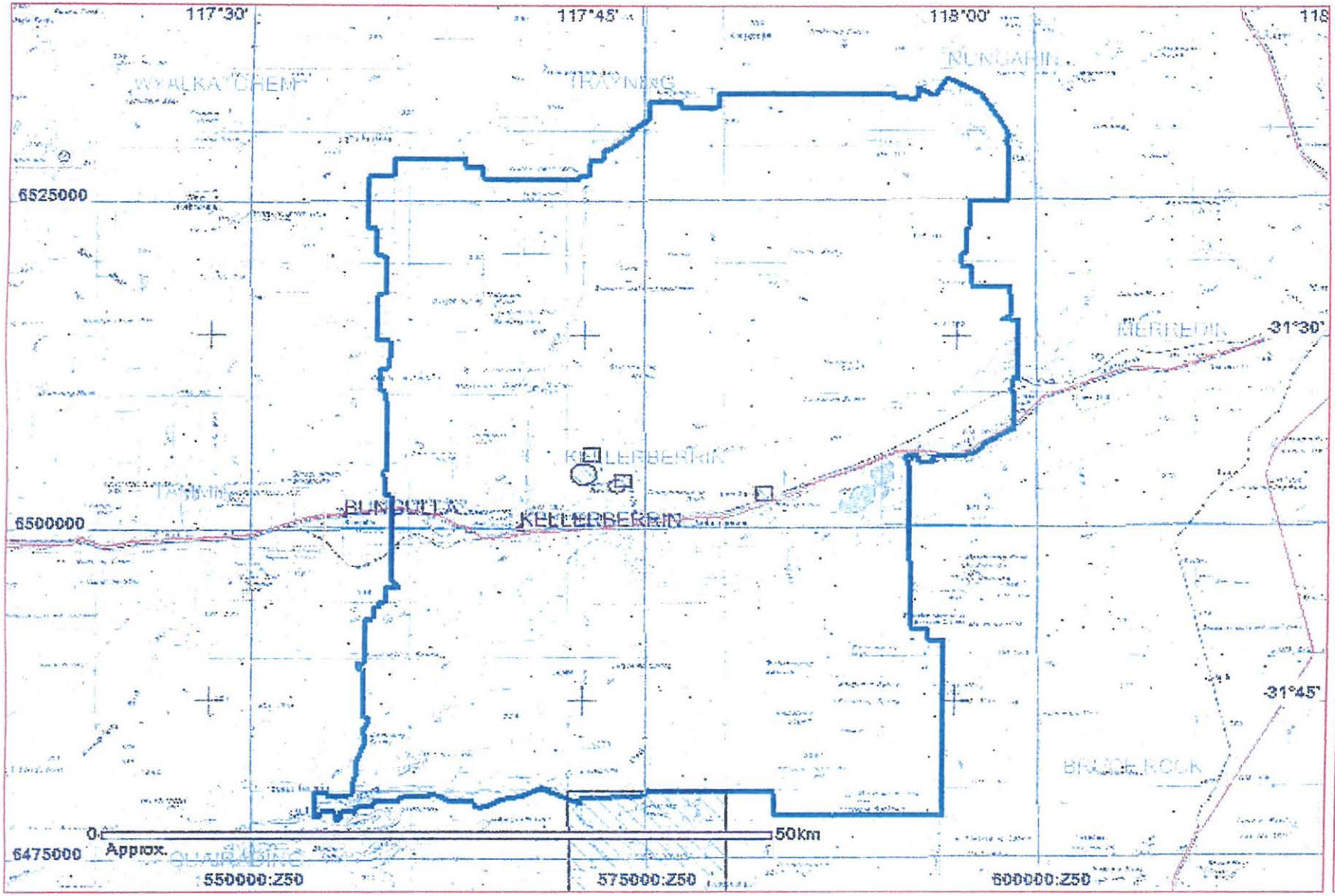
Legend

Restriction		Access		Status		Coordinate Accuracy	
N	No restriction	C	Closed	I	Interim register	Accuracy is shown as a code in brackets following the site coordinates.	
M	Male access only	O	Open	P	Permanent register	[Reliable]	The spatial information recorded in the site file is deemed to be reliable, due to methods of capture.
F	Female access	V	Vulnerable	S	Stored data	[Unreliable]	The spatial information recorded in the site file is deemed to be unreliable due to errors of spatial data capture and/or quality of spatial information reported.

Spatial Accuracy

Index coordinates are indicative locations and may not necessarily represent the centre of sites, especially for sites with an access code "closed" or "vulnerable". Map coordinates (Lat/Long) and (Easting/Northing) are based on the GDA 94 datum. The Easting / Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '5000000:Z50' means Easting=5000000, Zone=50.

Site ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site No.
5604	P	O	N	Doodlakine	Painting			582640mE 6502649mN Zone 50 [Unreliable]	S00548
15140	P	O	N	Jureen Rock	Painting			573240mE 6503249mN Zone 50 [Reliable]	S03044
5068	P	O	N	Kwolyin/kapbunglin	Ceremonial	Water Source		575141mE 6475149mN Zone 50 [Unreliable]	S00095
5069	P	O	N	Mooranoppin Rock?	Painting			571640mE 6505649mN Zone 50 [Unreliable]	S00096
5070	P	O	N	Old Jiriny Mission.	Skeletal material/Burial, Painting	Water Source		573640mE 6503649mN Zone 50 [Unreliable]	S00097
5071	P	O	N	Shark Mouth, Kellerberin	Ceremonial, Painting		*Registered Informant names available from DIA.	571140mE 6504149mN Zone 50 [Unreliable]	S00098



Legend

- Highlighted Area
- Town
- Map Area
- Search Area

Search Criteria

Site 5605

Disclaimer

Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist. Consultation with Aboriginal communities is on-going to identify additional sites. The AHA protects all Aboriginal sites in Western Australia whether or not they are registered.

Copyright

Legend

Restriction		Access		Status		Coordinate Accuracy	
N	No restriction	C	Closed	I	Interim register	Accuracy is shown as a code in brackets following the site coordinates.	
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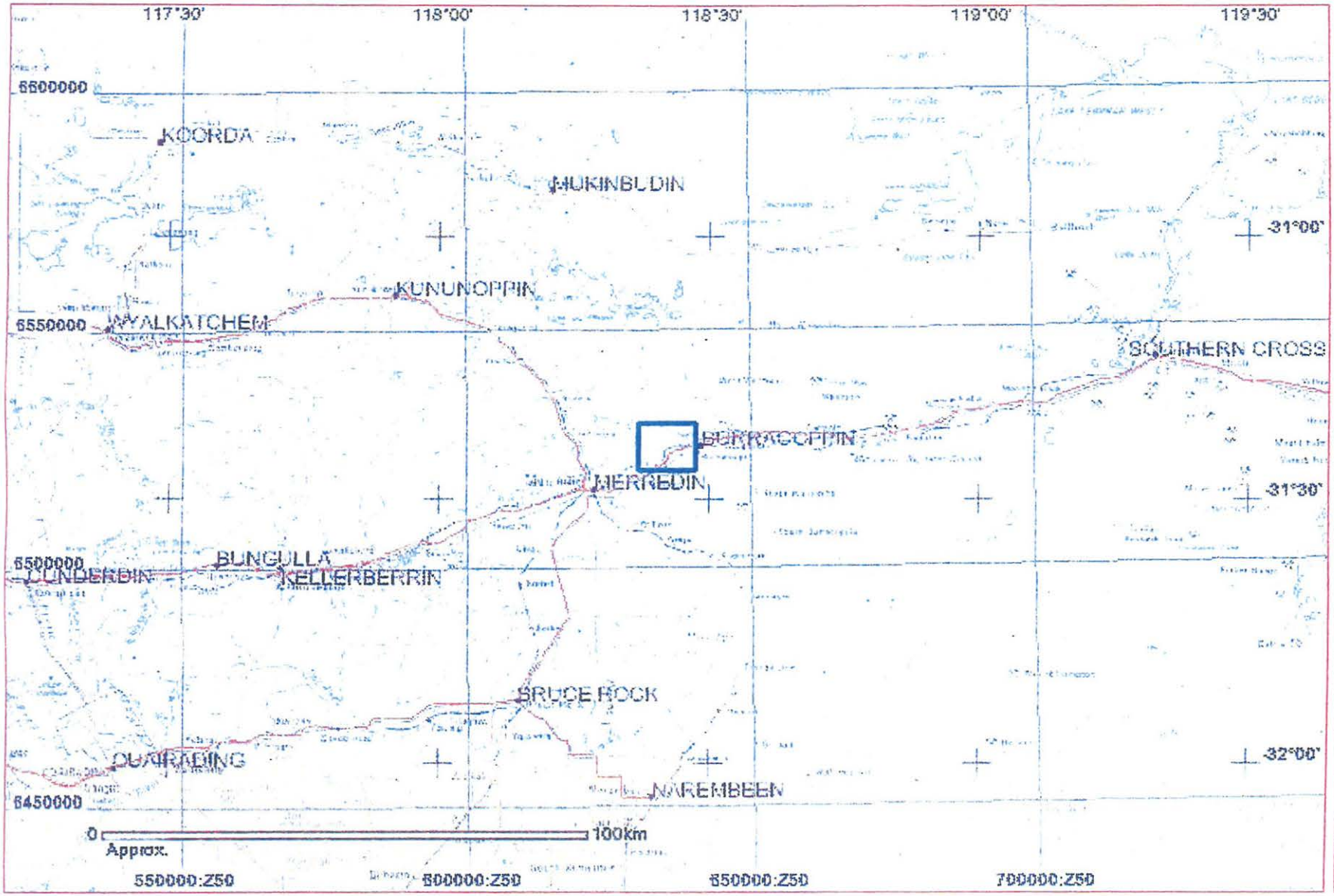
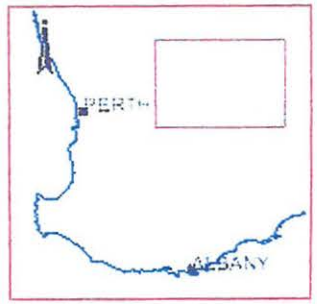
F	Female access	V	Vulnerable	S	Stored data	[Unreliable]	The spatial information recorded in the site file is deemed to be unreliable due to errors of spatial data capture and/or quality of spatial information reported.

Spatial Accuracy

Index coordinates are indicative locations and may not necessarily represent the centre of sites, especially for sites with an access code "closed" or "vulnerable". Map coordinates (Lat/Long) and (Easting/Northing) are based on the GDA 94 datum. The Easting / Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '5000000:Z50' means Easting=5000000, Zone=50.

Site ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site No
5605	I	O	N	Talgermine Rock.		[Other: STONE FOOTPRINT]		635141mE 6525149mN Zone 50 [Unreliable]	S00549





Legend

- Highlighted Area
- Town
- Map Area
- Search Area

Search Criteria

Search on a search polygon. The polygon is formed by these points (in order)

MGA Zone 50	
Northing	Easting
6532000	642000
6521000	642000
6521000	665000
6532000	665000

Disclaimer

Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist. Consultation with Aboriginal communities is on-going to identify additional sites. The AHA protects all Aboriginal sites in Western Australia whether or not they are registered.

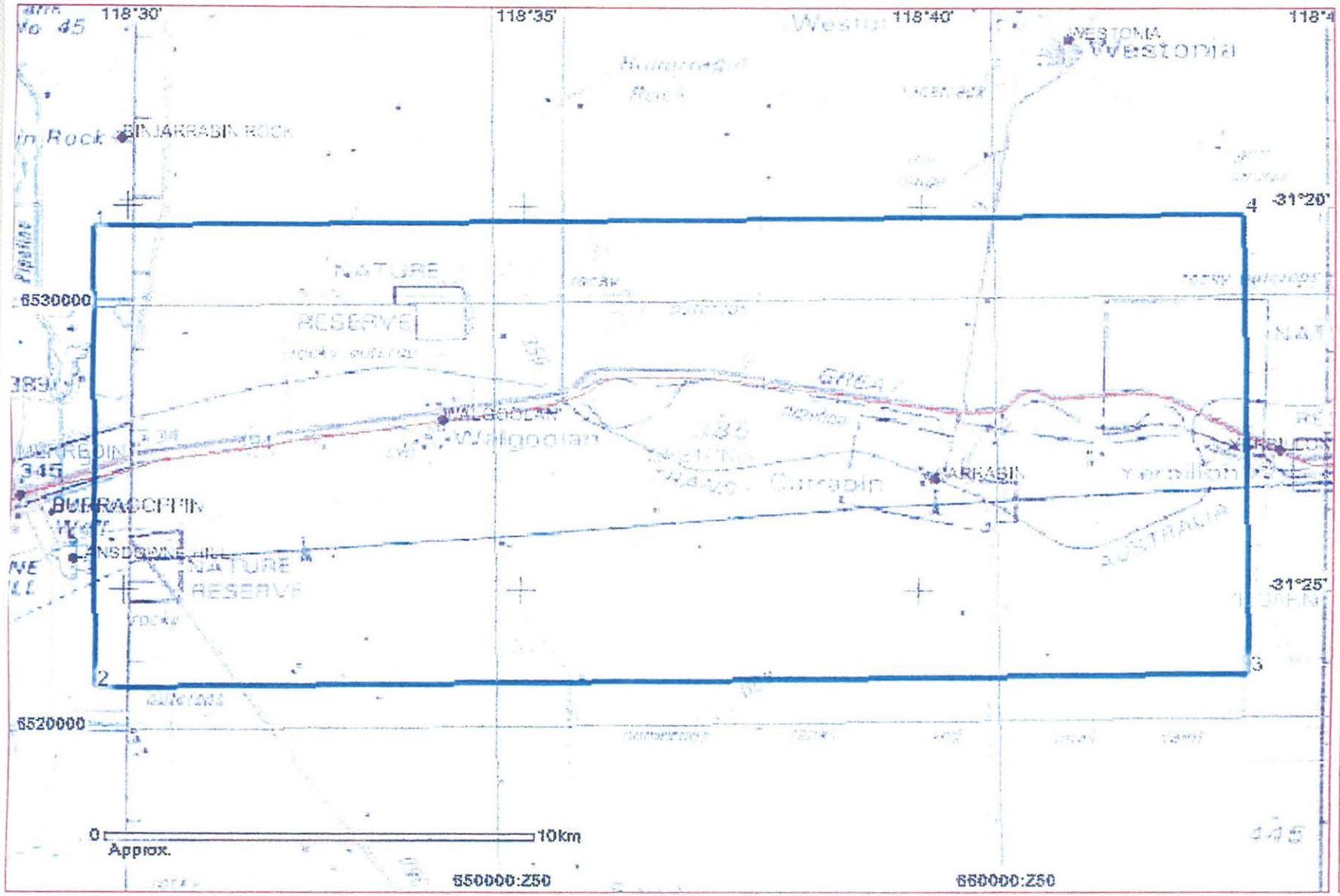
Copyright

Legend

Restriction		Access		Status		Coordinate Accuracy	
N	No restriction	C	Closed	I	Interim register	Accuracy is shown as a code in brackets following the site coordinates.	
M	Male access only	O	Open	P	Permanent register	[Reliable]	The spatial information recorded in the site file is deemed to be reliable, due to methods of capture.
F	Female access	V	Vulnerable	S	Stored data	[Unreliable]	The spatial information recorded in the site file is deemed to be unreliable due to errors of spatial data capture and/or quality of spatial information reported.

Spatial Accuracy

Index coordinates are indicative locations and may not necessarily represent the centre of sites, especially for sites with an access code "closed" or "vulnerable". Map coordinates (Lat/Long) and (Easting/Northing) are based on the GDA 94 datum. The Easting / Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '5000000:Z50' means Easting=5000000, Zone=50.



Legend

- Highlighted Area
- Town
- Map Area
- Search Area

APPENDIX 6
ACOUSTIC ASSESSMENT REPORTS FOR DP 8

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ACOUSTIC ASSESSMENT

GREAT EASTERN HIGHWAY DESIGN PACKAGES 6, 8 AND 10

FOR

ALINE EAST

BY

HERRING STORER ACOUSTICS

AUGUST 2006

REFERENCE: 6414-1-05198-02

CONTENTS

1.0 INTRODUCTION

Herring Storer Acoustics (HSA) has been commissioned by ALine East to assess the impact of future road traffic noise levels received at residence located adjacent to Packages 6, 8 and 10 of the Great Eastern Highway modifications. It is understood that Packages 6, 8 and 10 are as follows:

- Package 6 is between chainage 234300 and 235800.
- Package 8 is between chainage 264000 and 267000
- Package 10 is between chainage 257800 to 258960
- is from the Department of Agriculture Research Station to just into Merredin townsite (SLK 251.6 to 256.25).

The acoustic assessment has been carried out for current flows and for 20 years hence (2025). Analysis was based on vehicle traffic data supplied by ATA Environmental.

2.0 SUMMARY

The assessment of acceptable road traffic noise has been made in accordance with Main Roads Western Australia (MRWA) *Noise Level Objectives*. MRWA objectives cite an $L_{10,18hour}$ value of 63 dB(A) as being acceptable.

The Western Australian Planning Commission (WAPC) in May 2005 released a Draft Planning Policy for Road and Rail Transport Noise. The appropriate criteria in this case would be Noise Exposure 2, which cites the following noise limits:

Day	L_{Aeq} 60
Night	L_{Aeq} 55

Predictions were made for noise received at residence located adjacent to the road modifications will comply with the MRWA noise level objectives and the WAPC Draft Planning Policy for Road and Rail Transport Noise up to and including the year 2025, subsequently no noise amelioration is required.

Note: Given the minor nature of the modifications, we do not believe that the WAPC Draft Planning Policy for Road and Rail Transport Noise would, with the exception of the residence at chainage 259450, be applicable for these packages.

3.0 CRITERIA

3.1 Main Roads Western Australia – Noise Level Objectives

Main Roads Western Australia have criteria known as *Noise Level Objectives*, which include both a day and night time permissible noise level. These are stated as:

"Noise level criteria to be used in the assessment are the Noise Level Objectives specified in Table [3.1] below. Objectives are specified upper limits of traffic noise which it is intended, should not be exceeded. Objectives apply outside residential buildings, and outside public buildings such as hospitals, schools and libraries. In the case of public buildings there is a scope to relax the objectives if affected rooms are air-conditioned, and therefore normally used with windows closed.

TABLE 3.1 - NOISE LEVEL OBJECTIVES

Base Objective	*Objective for High Ambient Areas*
63 dB(A) $L_{10(18hour)}$	*Ambient + 3 dB(A)*
55 dB(A) $L_{eq(8hour)}$	*Ambient + 3 dB(A)*

Notes:

(1) Noise levels are $L_{10\ (18hour)}$ values, from 6am to midnight, and $L_{eq(8hour)}$ values from 10 p.m. to 6 a.m.

(2) Ambient noise is the level of noise before the road project commences

(3) A high ambient area is where ambient noise is more than 60 dB(A) $L_{10(18hour)}$, or 52 dB(A) $L_{eq(8hour)}$.

(4) Due to the impracticality of controlling noise at the upper floors of multi-storey buildings, noise assessment is restricted to the ground floor level.

(5) Noise is assessed 1 metre from a building, and 1.2 to 1.5 metres above the ground floor level.

(6) The objectives apply to the expected 15 to 20 years after opening of the road project, using available traffic forecasts.

(7) Noise level objectives relate to the total traffic noise expected at a building facade, i.e. noise from the new road and any other roads"

3.2 WAPC – Draft Planning Policy for Road and Rail Transport

The Western Australian Planning Commission (WAPC) in May 2005 released a Draft Planning Policy for Road and Rail Transport Noise. The criteria stated in the draft policy is as follows:

5. Policy measures

5.1 Exposure criteria for outdoor noise levels

Table 1 below sets out the outdoor noise exposure criteria for noise-sensitive premises as defined in this policy. These standards are generally consistent with noise criteria adopted in other Australian states where performance criteria or guidelines have been adopted in recent years.

TABLE 1 – EXTERNAL NOISE EXPOSURE CRITERIA FOR NOISE-SENSITIVE LAND USES

Time Period	*External Noise Exposure Level[1] Criteria (dB)*		
	Exposure Level 1 (Target)	*Exposure Level 2*	*Exposure Level 3*
Day *6.00a – 10.00pm*	*Less than L_{Aeq} 55*	*L_{Aeq} 55-60*	*Above L_{Aeq} 60*
Night *10.00pm – 6.00am*	*Less than L_{Aeq} 50*	*L_{Aeq} 50-55*	*Above L_{Aeq} 55*
Additional criteria for railways	*Less than L_{Amax} 75*	*L_{Amax} 75-80*	*Above L_{Amax} 80*

Note [1] Noise levels is to be determined at a point 1 metre from the edge of the site or building façade that is the most exposed to traffic noise, and at a height of 1.5 metre from the ground level at that point. Noise assessments should generally reflect the impact of any future growth in road and rail traffic, based on a 20 year forecast period.

5.2 Exposure Level 1 (Target)

Exposure level 1 refers to a level of outdoor noise that is considered a desirable target for residential and other noise-sensitive development. It will apply primarily to integrated greenfields planning of road or rail infrastructure and adjoining development. In situations where either infrastructure or residential development is already in existence, achievement of this target may not be practicable.

Where residential or other noise-sensitive development is proposed on a site, which is subject to Exposure Level 1, no action is required under this policy in relation to the management or amelioration of transport noise. However, it needs to be recognised that, because some people are more sensitive to noise than others, a proportion of the population may still be affected by noise which falls within Exposure Level 1.

5.3 Exposure Level 2

Exposure Level 2 refers to a level of outdoor noise exposure that would be acceptable for residential and other noise-sensitive development, subject to appropriate measures to ameliorate noise impact.

For road or rail infrastructure with a noise exposure level in this range, new noise sensitive development should be designed and constructed so as to comply with:

- *The 'target' Exposure Level 1 for required outdoor living areas; and*
- *The 'satisfactory' criteria under Australian Standard AS2107:2000 "Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors", for indoor areas.*

Exposure Level 2 generally represents the maximum noise exposure for proposed new road and rail infrastructure and noise-sensitive development on land adjoining such infrastructure, but may not be practicable for many of the existing major road and rail corridors.

5.4 Exposure Level 3

Exposure Level 3 refers to a level of outdoor noise exposure that is not generally regarded as acceptable for conventional residential or other noise-sensitive development.

*For **new or upgraded roads and railways** where the predicted noise levels are in this range at nearby noise-sensitive site, noise management measures in conjunction with the new or upgraded infrastructure are mandatory, with the objective of achieving Exposure Level 2 or better.*

*For **existing road or rail infrastructure** with a noise exposure level in this range, new noise sensitive development should where practicable, be designed and constructed so as to comply with:*

- *The 'target' Exposure Level 1 for required outdoor living areas; and*
- *the 'satisfactory' criteria under Australian Standard AS2107:2000 "Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors", for indoor areas.*

In determining the practicability of compliance with the criteria, it needs to be recognised that a significantly higher level of noise attenuation would generally be required for sites affected by Exposure Level 3 compared to Exposure Level 2. Accordingly, it may not always be practicable to achieve compliance with the criteria, although special attention should be given to meeting the indoor noise standards. Refer to section 5.10 for guidance on the determination of practicability.

In this case Exposure Level 2 would be the appropriate criteria, therefore, the day and night periods criteria would be:

Day	L_{Aeq} 60
Night	L_{Aeq} 55

Note: Under Section 3 of the Draft Planning Policy, the policy should be applied to major upgrading of existing roads.

Under Appendix 1; Glossary of Terms, an Upgraded transport corridor is defined as "works which involve or are designed to facilitate a substantial increase in traffic carrying capacity and/or heavy vehicle traffic, or a substantial change in the alignment through design or engineering changes (excluding minor road/rail works or minor changes to road/rail alignments or a change in alignment that is required for safety reasons).

Based on the above, we do not believe that Packages 1 and 2 would be considered as major upgrade, but would be a minor change and in this case the policy should not apply.

4.0 CALCULATIONS

Based on the data provided by ATA Environmental (predicted traffic volumes for 2025), the computer program 'TNoise' was used to predict the noise levels received at various premises. Information relevant to the calculations is shown below in Table 4.1.

TABLE 4.1 - NOISE MODELLING INPUT DATA

Parameter	Value
Traffic Volumes	
Year 2005	1400
Year 2025	1710
% Heavy Vehicles	34
Speed (km/hr) Outside Merredin Within Merredin	 110 70
Road Surface	Chip Seal

* Based on 1% growth pr year over 20 years

Calculations were carried out for noise received at premises located at the following chainages:

L1 Chainage 236700-237000 at 14 and 18 metres from Highway
L2 Chainage 236820
L3 Chainage 236900
L4 Chainage 236800
L5 Chainage 237750
L6 Chainage 239020
L7 Chainage 239050
L8 Chainage 239150
L9 Chainage 258400-258500 at 22, 26 and 30 metres from Highway
L10 Chainage 258700
L11 Chainage 259450
L12 Chainage 260900
L13 Chainage 261000
L14 Chainage 261100
L15 Chainage 257750

The predicted $L_{A10,(18hr)}$ noise levels for current flows (2005) and for the year 2025 are shown in Table 4.2.

TABLE 4.2 – CALCULATED $L_{A10,(18HR)}$ NOISE LEVEL

Locations	Calculated $L_{A10,(18hr)}$ dB(A)	
	Current	Year 2025
L1 – CHA 236700 – 237000 14m 18m	 63 63	 64 63
L2 – CHA 236820	52 (185m)	52 (185m)
L3 – CHA 236900	55 (90m)	56 (90m)
L4 – CHA 236800	49 (270m)	50 (270m)
L5 – CHA 237750	54 (105m)	55 (105m)
L6 – CHA 239020	56 (75m)	57 (75m)
L7 – CHA 239050	51 (210m)	52 (210m)
L8 – CHA 239150	52 (155m)	53 (155m)
L9 – CHA 258400 – 258500 22m 26m 30m	 59 59 58	 60 60 59
L10 – CHA 258700	60(20m)	61 (20m)
L11 – CHA 259450	54 (115m)	57 (75m)
L12 – CHA 260900	55 (95m)	56 (95m)
L13 – CHA 261000	55 (90m)	56 (90m)
L14 – CHA 261100	55 (100m)	56 (100m)
L15 – CHA 257750	53 (140m)	54 (140m)

( ) Distance between

From extensive monitoring carried out on similar roads, the difference between the $L_{10,18hour}$ and $L_{eq,16hour}$ (day period) and between the $L_{10,18hour}$ and $L_{eq,8hour}$ (night period) are approximately 3 and 9 dB(A) respectively. To calculate the current and future $L_{eq,16hour}$ and $L_{eq,8hour}$ it has been assumed that this same difference will exist in the current traffic flows and the year 2025. The resultant $L_{eq,16hour}$ (day period) and $L_{eq,8hour}$ (night period) are listed in Table 4.3.

TABLE 4.3 – CALCUALTED $L_{eq,(16hr)}$ AND $L_{eq,(8hr)}$

Location	Calculated Noise Level, dB(A)			
	(Day Period)		(Night Period)	
	Current	Year 2025	Current	Year 2025
L1 – CHA 236700 – 237000				
14m	60	61	54	55
18m	60	60	54	54
L2 – CHA 236820	49	49	43	43
L3 – CHA 236900	52	53	46	47
L4 – CHA 236800	46	47	40	41
L5 – CHA 237750	51	52	45	46
L6 – CHA 239020	53	54	47	48
L7 – CHA 239050	48	49	42	43
L8 – CHA 239150	49	50	43	44
L9 – CHA 258400 – 258500				
22m	56	57	50	51
26m	56	57	50	51
30m	55	56	49	50
L10 – CHA 258700	57	58	51	52
L11 – CHA 259450	51	54	45	47
L12 – CHA 260900	52	53	46	47
L13 – CHA 261000	52	53	46	47
L14 – CHA 261100	52	53	46	47
L15 – CHA 257750	50	51	44	45

Note: Calculation includes +2.5 dB(A) façade correction.

5.0 DISCUSSION

Predictions were made for noise received at noise sensitive premises located adjacent to the road modifications will comply with the MRWA noise level objectives and the WAPC Draft Planning Policy for Road and Rail Transport Noise up to and including the year 2025, subsequently no noise amelioration is required.

For: **HERRING STORER ACOUSTICS**

Tim Reynolds

03 August 2006

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ACOUSTIC ASSESSMENT

GREAT EASTERN HIGHWAY
DESIGN PACKAGE 8
RESIDENCE AT CHAINAGE 265750

FOR

ALINE EAST

BY

HERRING STORER ACOUSTICS

JULY 2006

REFERENCE: 6373-1-05198-03

CONTENTS

1.0 INTRODUCTION

Herring Storer Acoustics (HSA) has been commissioned by ATA Environmental to assess the impact of future road traffic noise levels received at residence located adjacent to Package 8 of the Great Eastern Highway modifications.

The acoustic assessment has been carried out for current flows and for 20 years hence (2025). Analysis was based on vehicle traffic data previously used for the analysis of packages 7 and 10.

2.0 SUMMARY

The assessment of acceptable road traffic noise has been made in accordance with Main Roads Western Australia (MRWA) *Noise Level Objectives*. MRWA objectives cite an $L_{10,18hour}$ value of 63 dB(A) as being acceptable.

The Western Australian Planning Commission (WAPC) in May 2005 released a Draft Planning Policy for Road and Rail Transport Noise. The appropriate criteria in this case would be Noise Exposure 2, which cites the following noise limits:

Day	L_{Aeq} 60
Night	L_{Aeq} 55

Predictions were made for noise received at residence located adjacent to the road modifications will comply with the MRWA noise level objectives and the WAPC Draft Planning Policy for Road and Rail Transport Noise up to and including the year 2025, subsequently no noise amelioration is required.

3.0 CRITERIA

3.1 Main Roads Western Australia – Noise Level Objectives

Main Roads Western Australia have criteria known as *Noise Level Objectives*, which include both a day and night time permissible noise level. These are stated as:

"Noise level criteria to be used in the assessment are the Noise Level Objectives specified in Table [3.1] below. Objectives are specified upper limits of traffic noise which it is intended, should not be exceeded. Objectives apply outside residential buildings, and outside public buildings such as hospitals, schools and libraries. In the case of public buildings there is a scope to relax the objectives if affected rooms are air-conditioned, and therefore normally used with windows closed.

TABLE 3.1 - NOISE LEVEL OBJECTIVES

Base Objective	*Objective for High Ambient Areas*
63 dB(A) $L_{10(18hour)}$	*Ambient + 3 dB(A)*
55 dB(A) *$L_{eq(8hour)}$*	*Ambient + 3 dB(A)*

Notes:

(1) Noise levels are $L_{10\ (18hour)}$ values, from 6am to midnight, and $L_{eq(8hour)}$ values from 10 p.m. to 6 a.m.

(2) Ambient noise is the level of noise before the road project commences

(3) A high ambient area is where ambient noise is more than 60 dB(A) $L_{10(18hour)}$, or 52 dB(A) $L_{eq(8hour)}$.

(4) Due to the impracticality of controlling noise at the upper floors of multi-storey buildings, noise assessment is restricted to the ground floor level.

(5) Noise is assessed 1 metre from a building, and 1.2 to 1.5 metres above the ground floor level.

(6) The objectives apply to the expected 15 to 20 years after opening of the road project, using available traffic forecasts.

(7) Noise level objectives relate to the total traffic noise expected at a building facade, i.e. noise from the new road and any other roads@

3.2 WAPC – Draft Planning Policy for Road and Rail Transport

The Western Australian Planning Commission (WAPC) in May 2005 released a Draft Planning Policy for Road and Rail Transport Noise. The criteria stated in the draft policy is as follows:

5. Policy measures

5.1 Exposure criteria for outdoor noise levels

Table 1 below sets out the outdoor noise exposure criteria for noise-sensitive premises as defined in this policy. These standards are generally consistent with noise criteria adopted in other Australian states where performance criteria or guidelines have been adopted in recent years.

TABLE 1 – EXTERNAL NOISE EXPOSURE CRITERIA FOR NOISE-SENSITIVE LAND USES

Time Period	*External Noise Exposure Level[1] Criteria (dB)*		
	Exposure Level 1 (Target)	*Exposure Level 2*	*Exposure Level 3*
Day 6.00a – 10.00pm	*Less than L_{Aeq} 55*	*L_{Aeq} 55-60*	*Above L_{Aeq} 60*
Night 10.00pm – 6.00am	*Less than L_{Aeq} 50*	*L_{Aeq} 50-55*	*Above L_{Aeq} 55*
Additional criteria for railways	*Less than L_{Amax} 75*	*L_{Amax} 75-80*	*Above L_{Amax} 80*

Note [1] Noise levels is to be determined at a point 1 metre from the edge of the site or building façade that is the most exposed to traffic noise, and at a height of 1.5 metre from the ground level at that point. Noise assessments should generally reflect the impact of any future growth in road and rail traffic, based on a 20 year forecast period.

5.2 Exposure Level 1 (Target)

Exposure level 1 refers to a level of outdoor noise that is considered a desirable target for residential and other noise-sensitive development. It will apply primarily to integrated greenfields planning of road or rail infrastructure and adjoining development. In situations where either infrastructure or residential development is already in existence, achievement of this target may not be practicable.

Where residential or other noise-sensitive development is proposed on a site, which is subject to Exposure Level 1, no action is required under this policy in relation to the management or amelioration of transport noise. However, it needs to be recognised that, because some people are more sensitive to noise than others, a proportion of

the population may still be affected by noise which falls within Exposure Level 1.

5.3 Exposure Level 2

Exposure Level 2 refers to a level of outdoor noise exposure that would be acceptable for residential and other noise-sensitive development, subject to appropriate measures to ameliorate noise impact.

For road or rail infrastructure with a noise exposure level in this range, new noise sensitive development should be designed and constructed so as to comply with:

- *The 'target' Exposure Level 1 for required outdoor living areas; and*
- *The 'satisfactory' criteria under Australian Standard AS2107:2000 "Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors", for indoor areas.*

Exposure Level 2 generally represents the maximum noise exposure for proposed new road and rail infrastructure and noise-sensitive development on land adjoining such infrastructure, but may not be practicable for many of the existing major road and rail corridors.

5.4 Exposure Level 3

Exposure Level 3 refers to a level of outdoor noise exposure that is not generally regarded as acceptable for conventional residential or other noise-sensitive development.

*For **new or upgraded roads and railways** where the predicted noise levels are in this range at nearby noise-sensitive site, noise management measures in conjunction with the new or upgraded infrastructure are mandatory, with the objective of achieving Exposure Level 2 or better.*

*For **existing road or rail infrastructure** with a noise exposure level in this range, new noise sensitive development should where practicable, be designed and constructed so as to comply with:*

- *The 'target' Exposure Level 1 for required outdoor living areas; and*
- *the 'satisfactory' criteria under Australian Standard AS2107:2000 "Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors", for indoor areas.*

In determining the practicability of compliance with the criteria, it needs to be recognised that a significantly higher level of noise attenuation would generally be required for sites affected by Exposure Level 3 compared to Exposure Level 2. Accordingly, it may not always be practicable to achieve compliance with the criteria, although special attention should be given to meeting the indoor noise standards. Refer to section 5.10 for guidance on the determination of practicability.

In this case Exposure Level 2 would be the appropriate criteria, therefore, the day and night periods criteria would be:

Day	L_{Aeq} 60
Night	L_{Aeq} 55

Note: Under Section 3 of the Draft Planning Policy, the policy should be applied to major upgrading of existing roads.

4.0 CALCULATIONS

Based on the data provided by ATA Environmental (predicted traffic volumes for 2025), the computer program 'TNoise' was used to predict the noise levels received at various premises. Information relevant to the calculations is shown below in Table 4.1.

TABLE 4.1 - NOISE MODELLING INPUT DATA

Parameter	Value
Traffic Volumes	
Year 2005	1400
Year 2025	1710
% Heavy Vehicles	34
Speed (km/hr) 'Open' Highway Townsites	 110 70
Road Surface	Chip Seal

* Based on 1% growth pr year over 20 years

Calculations were carried out for noise received at the following locations:

Package 8

L1 Residence to north of proposed alignment at approximately GLK 265750

L2 Residence to south of proposed alignment at approximately SLK 265750

The predicted $L_{A10,(18hr)}$ noise levels for current flows (2005) and for the year 2025 are shown in Table 4.2.

TABLE 4.2 – CALCULATED $L_{A10,(18hr)}$ NOISE LEVEL

Locations	Calculated $L_{A10,(18hr)}$ dB(A)	
	Current	Year 2025
L1 – North of Proposed Alignment	51 (190m)	57 (70m)
L2 – South of Proposed Alignment	47 (450m)	53 (150m)

( ) Approximate distance between proposed alignment and residence

From extensive monitoring carried out on similar roads, the difference between the $L_{10,18hour}$ and $L_{eq,16hour}$ (day period) and between the $L_{10,18hour}$ and $L_{eq,8hour}$ (night period) are approximately 3 and 9 dB(A) respectively. To calculate the current and future $L_{eq,16hour}$ and $L_{eq,8hour}$ it has been assumed that this same difference will exist in the

current traffic flows and the year 2025. The resultant $L_{eq,16hour}$ (day period) and $L_{eq,8hour}$ (night period) are listed in Table 4.3.

TABLE 4.3 – CALCUALTED $L_{eq,(16hr)}$ AND $L_{eq,(8hr)}$

Location	Calculated Noise Level, dB(A)			
	$L_{Aeq\ (18hr)}$ (Day Period)		$L_{Aeq\ (8hr)}$ (Night Period)	
	Current	Year 2025	Current	Year 2025
L1 – North of Proposed Alignment	48	54	42	48
L2 – South of Proposed Alignment	44	50	38	44

Note: Calculation includes +2.5 dB(A) façade correction.

5.0 DISCUSSION

Predictions were made for noise received at noise sensitive premises located adjacent to the road modifications will comply with the MRWA noise level objectives and the WAPC Draft Planning Policy for Road and Rail Transport Noise up to and including the year 2025, subsequently no noise amelioration is required.

For: **HERRING STORER ACOUSTICS**

Tim Reynolds

25 July 2006